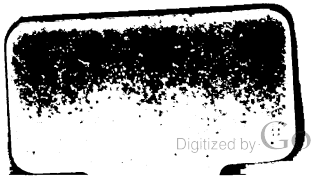

Cornwall 8° 56

A HANDBOOK

TO THE

MINERALOGY

OF

CORNWALL AND DEVON.

TRURO:
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A

HANDBOOK

TO THE

MINERALOGY

OF

CORNWALL AND DEVON,

WITH INSTRUCTIONS FOR THEIR DISCRIMINATION, AND COPIOUS TABLES OF LOCALITIES,

BY

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ASSOCIATE OF THE ROYAL GEOLOGICAL SOCIETY OF CORNWALL, AND OF THE ROYAL INSTITUTION OF CORNWALL, &c., &c.

TRURO:
HEARD AND SONS.

LONDON:
LONGMANS, GREEN, READER, AND DYER.

1871.

TO

ROBERT WERE FOX, F.R.S.,

&c., &c., &c.,

THE DISCOVERER OF THE

ELECTRICITY OF MINERAL LODES IN CORNWALL,

AND OF MANY CORNISH MINERALS,

(WHOSE OBSERVATIONS EXTEND OVER MORE THAN HALF A CENTURY),

THIS

HANDBOOK TO THE MINERALOGY OF CORNWALL AND DEVON

IS DEDICATED, BY

HIS SINCERE ADMIRER AND MOST OBEDIENT SERVANT,

THE AUTHOR.

PREFACE.

This Handbook is the product of the few hours of brief leisure of a busy life.

It is intended primarily as a Work of Reference for the Student, the Mine Agent, and the Working Miner: that such a work has been much needed will be conceded by all.

The Author cannot hope to have altogether escaped errors; and no doubt omissions and faults are not wanting.

The faults are his own; but he trusts there are also *some* excellencies, since he has received valuable assistance from those who have been well acquainted with the subject for many years.

His thanks are especially due to Robert Were Fox, Esq., F.R.S.; Robert Hunt, Esq., F.R.S.; Professor Warington W. Smyth, F.R.S.; Wm. Jory Henwood, Esq., F.R.S.; Professor A. H. Church; Richard Pearce, Esq., F.G.S.; and many other gentlemen, who have favoured him with information as to localities, &c.

FALMOUTH, September, 1871.

LIST OF WORKS CONSULTED.

Reports of the Royal Geological Society of Cornwall, Vols. I. to VII.

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A Glossary of Mineralogy, by H. W. Bristow, 1861.

The Mineralogist's Directory, by T. M. Hall, 1868.

A System of Mineralogy, by J. D. Dana, 1868.

Journal of the Chemical Society,

Chemical News.

Geological Magazine.

Philosophical Magazine, &c., &c.

LIST OF ABBREVIATIONS OCCASIONALLY EMPLOYED.

B., etc., *for* Blowpipe and other "dry" reactions.
Comp. ,, Chemical Composition.
Loc. ,, Localities.
Obs. ,, Observations.
OF ,, Oxidizing Flame.
RF ,, Reducing Flame.
Co. ,, Nitrate of Cobalt *(in Solution.)*
Sol. ,, Soluble.
Insol. ,, Insoluble.
HCl. ,, Hydrochloric Acid.
H_2SO_4 ,, Sulphuric Acid.
HNO_3 ,, Nitric Acid.
KHO ,, Caustic Potash *(in Solution.)*
Fus. ,, Fusibility.
C. ,, Charcoal.
Micro ,, Microcosmic Salt.
Soda ,, Carbonate of Soda.
H. ,, Hardness.
G. ,, Specific Gravity.

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PART I.

PART II.

ERRATA.

P. 12, Pt. II., col. 2, *Loc.*, line 10. For *Carharrack* read *Carharrack, St. Just.*
P. 34, Pt. II., col. 1, *Loc.*, line 18. For *Tin* read *Cassiterite.*
P. 71, Pt. II., col. 1, line 23. For *Kerargyrite* read *Kerate.*

A HAND-BOOK

TO THE

MINERALOGY OF

CORNWALL AND DEVON.

PART I.

CHAPTER I.

INTRODUCTORY.

A perfect definition is proverbially a very difficult, if not impossible, thing to produce. The definition of a mineral is no exception, but one of the best runs as follows:—"A mineral is any *natural*, *homogeneous body*, *inorganically* produced." This definition is defective, inasmuch as it *excludes* coal, as well as bog iron ore and some other substances, usually described as minerals; but if the third character be not too rigidly applied it is tolerably correct.

The student having obtained a new specimen is naturally desirous to know what its properties are. He will then desire to determine whether any similar mineral has been described before. Next he will wish to know how to arrange it with his other specimens, as well as where it has occurred before; and, finally, he will endeavour to ascertain the conditions of its occurrence. A division of the Science of Mineralogy into the following five sections (as defined on p. 70, Part II.) would therefore seem to be tolerably natural.

SECTION 1. Determinative.
" 2. Descriptive.
" 3. Systematic.
" 4. Distributive.
" 5. Paragenetic.

In this "Handbook" only a very brief outline of these various branches can be given. Such an outline may, however, prove sufficient for many miners and amateurs, and it may also serve as a convenient introduction to larger and more complete works for those who desire to pursue the subject. For special and detailed instruction in the use of the blowpipe the author would recommend "An Introduction to the Use of the Mouth-Blowpipe," by T. Scheerer and H. F. Blandford (Williams and Norgate, 1864), or the large work of Professors Plattner and Muspratt, published by Messrs. Churchill.

A list of the apparatus used for the experiments described in this Handbook is appended. Those marked thus, (*), are essential; for the others an ingenious student will usually be able to devise substitutes.

* 1. Blowpipe (Dr. Black's form is convenient and cheap).
* 2. An oil-lamp with flat wick, or a thick candle.
3. A spirit lamp.
* 4. Several pieces of charcoal.
* 5. Small glass tubes, open, and sealed at one end.
* 6. Borax.
* 7. Carbonate of soda.
* 8. Microcosmic salt.
* 9. Solution of nitrate of cobalt.
10. A small mortar of porcelain, or, much better, of agate or jasper.

11. Brass forceps, with platinum points.
12. Small steel-faced hammer and anvil.
13. Three-sided file, finely cut, for trying the hardness of minerals, cutting glass tubes, &c.
* 14. A magnet.
* 15. A pocket magnifying glass.
16. Several watch-glasses.
17. Several test tubes.
18. Potassic bisulphate.
19. Boric acid.
20. Fluor spar.
21. Gypsum.
22. Oxide of copper.
23. Metallic lead, tin, copper, and iron, in thin plate or foil, and fine wire.
24. Bone ash.
25. Test papers—litmus or turmeric, and Brazil wood.
26. Distilled water.
27. Sulphuric acid.
* 28. Nitric acid.
* 29. Hydrochloric acid.
* 30. Ammonia in solution.
31. Caustic potash in solution.
* 32. Thin platinum wire.
33. Platinum foil.
34. Scale of hardness.
35. Scale of fusibility.
36. Penknife.
37. Contact goniometer.

CHAPTER II.

DETERMINATIVE.

To determine the nature of an unknown mineral specimen it will be advisable to adopt a system, and to adhere closely to it, for some time at least. Supposing such a specimen to be placed in the hands of the student he should examine it carefully, noting down the results of his examination according to the instructions contained in this chapter.

A large number of minerals occur, at least occasionally, in more or less regular geometrical forms termed "crystals." These have been grouped into six "systems of crystallization," for convenience of study (see "Crystallography," p. 38, Part II.) It is no part of the purpose of this work to explain the subscience of crystallography;* but a great deal may be learnt by a careful comparison of the specimen under examination with the figures on Plates I. to X., with their explanations. If *amorphous*, or occurring in *imitative* forms, it should also be noted.

A portion of the specimen should now be powdered for examination according to the tables I. to X. While doing so a good opportunity is afforded for noticing its cleavage and fracture, and determining its "Hardness" and other PHYSICAL CHARACTERS.

Its peculiar OPTICAL CHARACTERS, as colour, lustre, &c., should be at the same time carefully noted, after which the student may proceed to test its CHEMICAL CHARACTERS with the aid of the tables given.

These observations may very well be made in the order indicated below. Most of the terms used are specially explained in another part of the work.

* Those who wish to follow up this delightful part of the subject will do well to procure Nicol's "Manual of Mineralogy," Naumann's "Elemente der Mineralogie," or some similar work.

1. FORM—
   Crystallized, Crystalline, } See Crystallography, p. 38.
   Amorphous, Imitative, } See Form, p. 48.
2. PHYSICAL CHARACTERS other than form—
   Cleavage, see p. 34.
   Fracture, Frangibility or Tenacity, } See p. 48.
   Hardness, see p. 54.
   Specific Gravity, see p. 94.
   Magnetism, see p. 66.
   Electricity, see p. 42.
3. OPTICAL CHARACTERS—
   Colour, see p. 35.
   Streak, see p. 98.
   Lustre, see p. 65.
   Diaphaneity, see p. 41.
   Phosphorence, see p. 77.
   Fluorescence, see p. 47.
   Refractive Power.
   Polarization.
4. CHEMICAL CHARACTERS—
   Fusibility, see p. 49.
   Solubility, see p. 94.
   Taste, see p. 100.
   Odour, see p. 72.
   Adhesion to tongue.
   Touch, see p. 102.
5. BLOWPIPE REACTIONS, see p. 18.

The specimen to be examined by the aid of the following tables should be selected as free as possible from foreign matter and reduced to a coarse powder, in a mortar or otherwise. It should then be subjected to the experiments detailed on p. 18, Part II., and the results compared with the following tables, which are applicable to substances of artificial production, as well as to minerals.

TABLE I.—REACTIONS IN MATRASS.

EXP 1.—Heat a small portion in a matrass (see p. 18).

A. The substance turns black, and gives off pungent odours and much moisture. *Organic matter* is indicated.

B. The substance changes colour, but *no moisture or sublimate is evolved*—
   a. From *white, yellow, grey,* or *brown,* to *black.* The carbonates of iron, manganese, and some other substances behave thus. Carbonate of iron (*Chalybite*) becomes strongly magnetic; peroxide of iron (*Hematite*) is black while hot, but dark reddish-brown when cold.
   b. From *orange-red* to *brown* while hot, again *orange-red* on cooling. Potassic bichromate and some other chromates and bichromates behave thus.
   c. From *yellow* or *pink* to *reddish-brown* while hot, *yellow* when cold, fusible with a strong heat; oxide of lead is probable.
   d. From *yellow* to deep *orange-red* while hot, *lemon-yellow* when cold. Chromate of potash or some other chromate is probable.
   e. *White* or *pale yellow* to a stronger *yellow* while hot, losing colour again on cooling. Oxide of zinc or oxide of tin is indicated.
   f. *White* to *deep orange* or *reddish-brown* while hot, *yellow* when cold, fusible at a white heat. Oxide of bismuth is probable.

Many other substances change colour on heating, but most of them give off moisture or a sublimate at the same time, and are therefore included in other parts of this table.

C. The assay *decrepitates,* some *anhydrous* substance is indicated. When the powder is very fine this reaction is not often observed. Among minerals

WOLFRAM and BLENDE often decrepitate strongly; of artificial substances CHLORATE OF POTASH and NITRATE OF LEAD are good examples.

D. Water is given off, and deposited on the sides of the tube.

a. The assay *melts* at first, gives off *much* water, and finally re-solidifies. Salts containing *water of crystallization* are indicated. Among minerals *Melanterite* and *Kalinite* (alum) are good examples.

b. Gives off moisture without melting or swelling up. Many *hydrates* or *hydrous carbonates* behave thus. Those of the heavy metals often become much darker at the same time. Among minerals *Malachite*, *Chessylite*, and *Kaolin* are good examples. The first two turn nearly black; the third remains white.

c. The quantity of water may be inconsiderable, and given off at a *low temperature*. This is often *water of absorption*, taken up by the substance from the air.

In all cases the moisture should be *tested* with "*test paper*." If *acid*, some *volatile* acid, such as SULPHURIC or NITRIC, is indicated. If *alkaline*, AMMONIA is present.

E. The assay *fuses* more or less readily, but gives off little or no water. In such cases, while strongly heated, a fragment of charcoal should be dropped in. A *deflagration* will indicate a NITRATE, PER-NITRATE, CHLORATE, or PER-CHLORATE. This reaction is rarely to be expected when examining a *mineral* substance.

F. Gases and vapours other than steam are given off. (These will rarely be observed in *this* experiment with *mineral* substances.)

a. The gas *re-lights* a glowing splint of wood. Oxygen is indicated from CHLORATES, NITRATES, PEROXIDES, &c. The former are often *fusible; peroxides* will be usually *infusible*.

b. An odour of *burning sulphur* is noticed. *Sulphurous anhydride*, from SULPHATES and other bodies containing sulphur.

c. The gas is *brownish* or *reddish*. NITRATES and NITRITES are indicated.

d. The gas is colourless and without odour, but if conducted into "lime-water" renders it turbid. *Carbonic anhydride* from CARBONATES, *e.g.*, CALCITE, ARAGONITE, DOLOMITE, &c., among mineral substances.

e. The gas is *without colour* and has *but little* odour, but burns with a blue flame. *Carbonic oxide* from OXALATES and similar salts.

f. The gas burns with a *rose-coloured* flame. *Cyanogen* from CYANIDES, FERRO-CYANIDES, &c.

g. The gas has an odour like that of rotten eggs, and blackens "lead-paper." *Sulphuretted hydrogen* from SULPHIDES, &c.

h. Strong pungent odour, and turns reddened litmus paper *blue*. *Ammonia* from ammoniacal salts and *nitrogenous organic* compounds.

G. A "sublimate" is deposited.

WHITE.

a. Sublimes *after* fusion, substance very heavy. MERCURIC CHLORIDE is probable.

b. Sublimes *without* fusion; substance heavy; yellow while hot. MERCUROUS CHLORIDE is probable.

c. Sublimes *without* fusion; not heavy. AMMONIC CHLORIDE is probable.

d. Sublimes *without* fusion; substance rather heavy; sublimate crystalline. ARSENIC ANHYDRIDE, *Arsenolite*, if altogether volatile, or some METALLIC ARSENIDE, if mostly non-volatile.

e. Sublimes after fusion; substance very light. Benzoic or some other organic acid is probable.

YELLOW OR RED.

a. Fuses at first to a *yellow* liquid. OXIDE of ANTIMONY is probable.

b. *Red* or *reddish-yellow* while hot, *yellow* when cold. SULPHIDE of ARSENIC is indicated. (Orpiment and Realgar among mineral substances, as well as many sulpharsenides.)

c. Original substance *red*, and sublimate red when *rubbed*. Iodide of Mercury is probable.

d. Sublimate easily melts to reddish-brown drops. SULPHUR or some SULPHIDE is indicated.

BLACK, not SHINING
- a. Turns *red* when rubbed. SULPHIDE of MERCURY is indicated, from CINNABAR and other mercuric minerals.
- b. Remains black when rubbed. SULPHIDE of ANTIMONY, from ANTIMONITE and other minerals containing antimony.

BLACK or GREY & SHINING
- a. Runs into drops when rubbed. MERCURY is shewn to be present.
- b. Remains as an opaque crust. ARSENIC is probable, from many minerals containing ARSENIC.

In cases where a sublimate or a gas is given off, some additional information, or more precise results, may be obtained by making experiment 2. Whenever, by the foregoing table, ammonia, arsenic, mercury, or antimony are thought to be indicated, more distinct reactions may be obtained by mixing the assay with a little "Black Flux," and heating in a fresh matrass.

TABLE II.—REACTIONS IN OPEN TUBE.

EXP. 2.—Heat a fresh portion of the substance under examination in a tube, open at both ends, and held in an inclined position. (This experiment may be omitted in all cases where *no* change was effected by the first experiment.)

A. A white sublimate is formed. This may be—

WHITE.
- a. OXIDE of ANTIMONY, from ANTIMONITE, &c.
- b. OXIDE of ARSENIC, from ARSENIDES. This sublimate will be in brilliant crystals.
- c. OXIDE of BISMUTH, from BISMITE, BISMUTHINITE, &c. This would be *yellow* or *reddish-brown* while hot.
- d. CHLORIDE of LEAD. This is *readily* fusible.
- e. OXIDE of LEAD. *Yellow* while *hot; fusible* at a *red heat*.
- f. SULPHATE of LEAD, from Galena, &c.
- g. CHLORIDES of MERCURY, from Salts of Mercury.
- h. SELENITE of LEAD, from the very rare *Selenide*.
- i. OXIDE of MOLYBDENA, from minerals containing Molybdena. This sublimate is in *pale yellow* shining crystals.
- j. OXIDE of TELLURIUM, from the very rare metallic TELLURIDES.

YELLOW, RED, BROWN, or BLACK.
- These are precisely as in the first experiment, with the addition of molybdic anhydride, which sublimes in pale yellow crystals.

B. Gases or vapours may be evolved—
- a. SULPHUREOUS, from metallic *Sulphides*.
- b. Resembling GARLIC (alliaceous), from compounds containing *Arsenic*.
- c. Resembling DECAYING HORSE RADISH. From *Selenides* a red sublimate of Selenium is often deposited.

TABLE III.—REACTIONS ON CHARCOAL WITHOUT FLUXES.

EXP. 3.—Make a small cavity on the surface of a piece of charcoal, place a portion of the substance to be examined in it, direct the tip of the flame of a candle or oil-lamp upon it by means of the blowpipe, using first the "oxidising flame," afterwards the "reducing flame."

A. The substance melts, and is mostly absorbed by the charcoal without depositing an "incrustation." Many *alkaline* salts behave thus, but few *minerals*.

B. An *incrustation* is deposited on the charcoal, especially when the reducing flame is used. Sometimes a small metallic bead will be produced from the assay at the same time. Those most likely to be met with are the following :—

a. *White. Garlic odour.* ARSENIC is indicated. *Ex.* NATIVE ARSENIC, SMALTITE, &c.
b. *White. Little or no odour.* Brittle metallic globules in RF. ANTIMONY is indicated.
c. *White.* Yellow while hot; malleable bead. *Ex.* TIN.
d. *White.* Yellow while hot; no bead. *Ex.* ZINC.
e. *Yellow.* Soft malleable bead. *Ex.* LEAD.
f. *Yellow* or *orange.* Soft brittle bead. *Ex.* BISMUTH.
g. *Reddish-brown.* Easily volatilized; no bead. *Ex.* CADMIUM.
h. *Dark red.* Very bright white malleable bead. *Ex.* SILVER.

These reactions are often somewhat obscured by the presence of several together.

C. A *white*, or nearly white, residue is left on the charcoal. This may, perhaps, indicate Barium, Strontium, Lime, Magnesia, Alumina, Zinc, Silica. Proceed to Exp. IV., Table IV.

D. A dark coloured residue is left. This indicates the presence of some *heavy* metal. Proceed to Exps. as in Tables V., VI., VII.

E. The tip of the flame is seen to be *tinged* red, yellow, blue, green, &c. Examine by Exp., Table VIII.

TABLE IV.—REACTIONS WITH COBALT SOLUTION.

EXP. 4.—When a white residue is left from Exp. 3, either Baryta, Strontia, Lime, Magnesia, Oxide of Zinc, Alumina, or Silica is probably present. In such cases moisten with a drop of a solution of *Nitrate* of *Cobalt* (Co), and heat strongly again.

A. If it appears intensely luminous, Strontium, Lime, Magnesia, or Oxide of Zinc are probably present.

B. If as it cools, it turns—
a. *Blue.* ALUMINA is present; SILICA, if only pale blue.
b. *Green.* ZINC is present.
c. *Pink* or *red.* MAGNESIA is present.

TABLE V.—REACTIONS ON CHARCOAL WITH FLUXES.

EXP. 5.—When a dark coloured residue is left from Exp. 3, mix a little dry carbonate of soda with the assay and heat in the "Reducing Flame" (RF). See p. 18, Part II.

a. Yellow malleable bead = GOLD.
b. Red malleable bead = COPPER.
c. White malleable bead, dull as it cools, white incrustation = TIN.
d. White malleable bead, very bright, dark red incrustation = SILVER.
e. Grey malleable bead, yellow incrustation = LEAD.
f. Grey brittle bead, yellow incrustation = BISMUTH.
g. White brittle bead, white incrustation = ANTIMONY.
h. White incrustation, easily volatilized, with garlic odour, no bead = ARSENIC.
i. White incrustation, no odour, no bead, green when treated with Co = ZINC.
j. Reddish-brown incrustation, no bead = CADMIUM.

TABLE VI.—REACTIONS WITH BORAX BEAD.

EXP. 6.—Make a "borax bead" and examine a portion of the assay (after roasting if any sublimate was yielded by EXPS. 1 and 2), as in EXP. 6, p. 18, Part II. (Substances printed in italics are very rare.)

A.—Oxidising Flame.

A.—COLOURLESS BEADS.

HOT AND COLD.

Silica, Alumina, Binoxide of Tin, Baryta, Strontia, Lime, Magnesia, Oxide of Silver, *Glucina. Tellurous Anhydride.*	when highly saturated; opaque (white) by flaming.
Titanic Anhydride, Tungstic Anhydride, *Molybdic Anhydride*, Oxides of Zinc, *Cadmium*, Lead, Bismuth and Antimony.	when feebly saturated.

b.—YELLOW BEADS.

HOT.
- *Titanic Anhydride*, Tungstic Anhydride, Oxides of Zinc and Cadmium. — when highly saturated; on cooling colourless, & cloudy by flaming.
- Oxides of Lead, Bismuth, and Antimony. — when highly saturated; on cooling colourless.
- Sesquioxides of *Cerium*, Iron, and Uranium. — when feebly saturated; on cooling colourless.
- Sesquioxide of Chromium; when fully saturated; when cold, yellowish-green.
- *Vanadic Anhydride*; when cold, pale green.

c.—RED TO BROWN BEADS.

HOT.
- *Sesquioxide of Cerium*; on cooling yellow, enamel-like by flaming.
- Sesquioxide of Iron; on cooling yellow.
- Sesquioxide of Uranium; on cooling yellow, enamel-yellow by flaming.
- Sesquioxide of Chromium; on cooling yellowish-green.
- Sesquioxide of Iron, containing Manganese; on cooling yellowish-red.

COLD.
- Oxide of Nickel (reddish-brown to brown); violet while hot.
- Sesquioxide of Manganese (violet-red); violet while hot.
- Oxide of Nickel, containing Cobalt; violet while hot.

d.—VIOLET BEADS (AMETHYST-COLOURED).

HOT.
- Oxide of Nickel; on cooling reddish-brown to brown.
- Sesquioxide of Manganese; on cooling violet-red.
- Oxide of Nickel, containing Cobalt; on cooling brownish.

e.—BLUE BEADS.

HOT.
- Oxide of Cobalt; retains its colour on cooling.

COLD.
- Oxide of Copper (when highly saturated greenish-blue); green while hot.

f.—GREEN BEADS.

HOT.
- Oxide of Copper; when cold, blue or greenish-blue.
- Sesquioxide of Iron, containing Cobalt or Copper. — on cooling the colour changes, according to the proportion in which the various oxides are present, to light-green blue, or yellow.
- Oxide of Copper, containing Iron or Nickel. — on cooling the colour changes, according to the proportion in which the various oxides are present, to light-green blue, or yellow.

COLD.
- Sesquioxide of Chromium, yellowish-green; yellow to red while hot.
- *Vanadic Anhydride*, greenish; yellow while hot.

B.—Reducing Flame.

a.—COLOURLESS BEADS.

HOT AND COLD.
- Silica, Alumina, Binoxide of Tin. — when highly saturated cloudy by flaming.
- Baryta, Strontia, Lime, Magnesia, *Glucina*, Oxide of *Cerium*. — when highly saturated cloudy by flaming.
- Sesquioxide of Manganese; sometimes, on cooling, pale rose coloured.
- Oxides of Silver, Zinc, Cadmium, Lead, Bismuth, Antimony, Nickel, *Tellurous Anhydride*. — with strong blowing; with feeble blowing grey.

HOT.
- Oxide of Copper; when highly saturated; on cooling opaque and red.

b.—YELLOW TO BROWN BEADS.

HOT.
- *Titanic Anhydride* (yellow to brown); when highly saturated enamel-blue by flaming.
- Tungstic Anhydride (yellow to dark yellow); when cold brownish.
- *Molybdic Anhydride* (brown to opaque).
- *Vanadic Anhydride* (brownish); green when cold.

c.—BLUE BEADS.

HOT.
- Oxide of Cobalt; retains its colour on cooling.

d.—GREEN BEADS.

HOT AND COLD.
- Sesquioxide of Iron (yellowish-green); especially when cold.
- Sesquioxide of Uranium (yellowish-green); when highly saturated black by flaming.
- Sesquioxide of Chromium (light to dark emerald-green).

HOT.
- *Vanadic Anhydride*; brownish while hot.

e.—GREY AND CLOUDY BEADS.

COLD.
- Oxides of Silver, Zinc, *Cadmium*, Lead, Bismuth, Antimony, Nickel. — with feeble blowing; with strong blowing colourless.

f.—RED AND OPAQUE BEADS.

COLD.
- Oxide of Copper, when highly saturated; colourless while hot.

TABLE VII.—REACTIONS WITH MICROCOSMIC SALT.

Substances printed in italics are very rare.

A.—Oxidising Flame.

a.—COLOURLESS BEADS.

HOT AND COLD.
- Silica; soluble only in minute quantity.
- Alumina, Binoxide of Tin; soluble with difficulty.
- Baryta, Strontia, Lime, Magnesia. — when highly saturated become opaque by flaming.
- Tungsten, Antimony; Oxides of Zinc, Cadmium, Lead, Bismuth, *Titanium*. — if not too highly saturated.

b.—YELLOW BEADS.

HOT.
- Anhydrides of Tungsten, Antimony, *Titanium*; Oxides of Zinc, Cadmium, Lead, Bismuth. — when highly saturated; colourless on cooling.
- Oxide of Silver, yellowish; when cold opalescent.
- Sesquioxide of Iron. — when feebly saturated; on cooling colourless.
- ,, *Cerium*. — when feebly saturated; on cooling colourless.
- ,, Uranium; when cold yellowish-green.
- *Vanadic Anhydride*, deep yellow; when cold of a lighter shade.

COLD.
- Oxide of Nickel; while hot reddish.

c.—RED BEADS.

HOT.
- Sesquioxide of Iron. — when highly saturated; when cold yellow.
- ,, *Cerium*. — when highly saturated; when cold yellow.
- Oxide of Nickel, reddish; when cold yellow.
- Sesquioxide of Chromium, reddish; when cold emerald-green.

d.—VIOLET BEADS.

HOT. { Oxide of Manganese, brownish-violet; on cooling pale reddish-violet.

e.—BLUE BEADS.

HOT. { Oxide of Cobalt; when cold of the same colour.
COLD. { Oxide of Copper; green while hot.

f.—GREEN BEADS.

HOT. { Sesquioxide of Iron, containing Cobalt or Copper. / Oxide of Copper, containing Iron or Nickel. } on cooling the colour changes, according to the proportion in which the various oxides are present, to light green, blue, or yellow.
Oxide of Copper; when cold blue or greenish-blue.
Molybdic Anhydride, yellowish-green; when cold of a lighter shade.

COLD. { Sesquioxide of Uranium, yellowish-green; while hot yellow.
Sesquioxide of Chromium, emerald-green; while hot reddish.

B.—Reducing Flame.

a.—COLOURLESS BEADS.

HOT AND COLD. { Silica; but slightly soluble.
Alumina, Binoxide of Tin; soluble with difficulty.
Baryta, Strontia, Lime, Magnesia. } when highly saturated become opaque by flaming.
Oxides of Manganese, *Cerium*.
Oxides of Silver, Zinc, *Cadmium*, Lead, Bismuth. / Antimonious anhydride. / Oxide of Nickel, if the exp. be made on Charcoal. } with continued blowing.

b.—YELLOW TO RED BEADS.

HOT. { Sesquioxide of Iron; on cooling greenish, then reddish.
Titanic Anhydride, yellow; on cooling violet.
Vanadic Anhydride, brownish; when cold emerald-green.
Titanic Anhydride, containing Iron. } yellow; when cold
Tungstic Anhydride, ,, ,, } blood-red.

c.—VIOLET BEADS.

COLD. { *Titanic Anhydride*; yellow while hot.

d.—BLUE BEADS.

COLD. { Oxide of Cobalt; of the same colour when hot.
Tungstic Anhydride; while hot brownish.

e.—GREEN BEADS.

COLD. { Sesquioxide of Uranium; while hot less bright.
Molybdic Anhydride; while hot of a dirty green colour.
Vanadic Anhydride; while hot brownish.
Sesquioxide of Chromium; while hot reddish

f.—GREY AND CLOUDY BEADS.

COLD. { Oxides of Silver, Zinc, *Cadmium*, Lead, Bismuth, Antimony, Nickel. } takes place quickest on Ch; with continued blowing colourless.

g.—RED AND OPAQUE BEADS.

COLD. { Oxide of Copper, when highly saturated, or with Tin on Charcoal.

TABLE VIII.—FLAME COLOURATIONS.

EXP. 8.—A fragment of the substance under examination is held by platinum-pointed forceps, and the tip of the oxidising flame is directed on it—a piece of platinum wire with a little of the powder sticking to it will usually suffice. (*Note*—Substances containing easily reduceable metals, as *tin* or *lead*, or substances which yield sublimates by Exp. 1, should not be thus treated, as the platinum forceps would be spoiled. The experiment may, however, be made by using charcoal, or a fragment of narrow glass tube, &c., as the support.)

A. The flame is tinged strongly yellow.

Sodium in some form is indicated.

B. Blue.

a. Chloride of Copper (ATACAMITE) colours the flame at first intensely blue, afterwards greenish.
b. Bromide of Copper. This is very rare.
c. Arsenic. This is a pale blue.
d. Antimony. This gives a pale greenish-blue.
e. Lead. Bright blue.
f. Selenium. Intense blue.

These substances are easily distinguished from each other by Exps. 1, 2, 3.

C. Green.

a. Baryta and its compounds. Yellowish-green.
b. Molybdenum and its compounds. Yellowish-green.
c. Copper and its compounds, except the chloride.
d. Telluric anhydride. This is very rare.
e. Phosphorus and compounds. Pale bluish-green.
f. Boric Acid or Anhydride.

D. Red.

a. Lithia. Very intense crimson.
b. Strontia. Crimson.
c. Lime. Brick red.

E. Violet.

Potash. This tint is often overpowered by the presence of the yellow flame of soda, but it may always be detected by looking through a piece of deep blue glass, which completely absorbs the yellow without interfering with the violet rays.

Many of the above flame colourations are well brought out by the application of a drop of hydrochloric acid, applied to the powder before heating. For phosphorus and phosphates sulphuric acid affords the most delicate reactions.

TABLE IX.—REACTIONS WITH SOLVENTS.

A. Water.

Very few minerals are soluble in water. Those that occur in Cornwall and Devon are:—

Melanterite,	*Johannite*,	*Goslarite*,
Cyanosite,	*Kalinite*,	*Halite*.

A large number of artificial products are soluble in water, including nearly all *nitrates*, *acetates*, and *oxalates*, *chlorides* (except those of lead, mercury, and silver), many *sulphates*, the *carbonates* and *oxides* of the alkalies, &c.

B. Hydrochloric acid, dilute or concentrated, gently warmed if necessary.

a. With effervescence.

1. The gas evolved has little or no smell, and if conducted into "lime water" yields a white precipitate. The carbonates of lime, magnesia, manganese, iron, and most other carbonates behave thus.
2. The gas evolved has a strong sulphureous odour. Many sulphites and hypo-sulphites behave thus.
3. Odour resembling that of rotten eggs. Many sulphides.

b. Without effervescence.

Silicates containing only a small proportion of silica, silicates of the alkalies, &c. These usually leave a gelatinous or slimy deposit of silica undissolved.

C. Nitric Acid; dilute or concentrated; warmed if necessary.

Substances having a metallic lustre should be treated with nitric acid, when they will often be dissolved or decomposed; red nitrous fumes being at the same time given off from the acid.

D. Aqua Regia, concentrated and warmed, in cases where nitric acid and hydrochloric acid have both failed.

Gold, Platinum, and many other substances, which are scarcely, or not at all, acted upon by HCl or HNO_3, are readily decomposed by Aqua Regia.

E. Special solvents.

a. Sulphuric Acid. Not often necessary, but useful for some few minerals.

b. Ammonia. Chloride of Silver and Chloride of Copper are readily soluble in ammonia.

c. Caustic Potash. Opal and some other minerals are partially or completely dissolved in Potash.

d. Hydrofluoric Acid. Useful for the solution of silica and all silicates.

The substance having been brought into solution will be in a fit state for examination according to the methods described in all works on qualitative analysis. Valuable information may, however, be often obtained from the colour of the solution. Thus, if it be

BLUE, Copper is probably present.
GREEN, Nickel, Iron, or Manganese.
PINK, Cobalt or Manganese.
YELLOW or BROWN, Gold, Iron, Platinum, or Chromium.

A good deal of information may also be gained by observing the *colour, appearance*, &c., of the substance when powdered. Thus if it be—

A. BLACK, and comparatively heavy, one or more of the oxides of Manganese, Copper, Iron, Nickel, or Cobalt; or of the sulphides of Mercury, Silver, Copper, Bismuth, Lead, Antimony, Iron, Cobalt, Nickel, &c., may be present.

B. BLACK, and very light, Carbon in some form.

C. BROWN, Peroxide of Iron, or Sulphide of Tin, &c.

D. RED, some oxides of Mercury, Lead, Iron, Copper, &c.; Sulphides of Mercury or Arsenic; Iodide of Mercury; Chromate of Potash, Ferridcyanide of Iron, Perchloride of Platinum, &c., may be present.

E. YELLOW, Chromates of Potassium, Sodium, Ammonium, Barium, Strontium, Calcium, Bismuth, Lead, &c.; Sulphides of Cadmium, Arsenic, Tin, &c.; Oxides of Lead, Tin, Bismuth; Ferrocyanide of Potassium; Iodide of Lead, &c.

F. GREEN, Oxide of Mercury; many salts of Iron, Copper, Nickel, Chromium; Manganates of Potash and Soda, &c.

G. BLUE, Salts of Copper; anhydrous Salts of Cobalt, Phosphate of Iron, Prussian Blue, Ultramarine, &c.

H. WHITE or COLOURLESS. Absence of either of the above in any considerable quantity; probable presence of silica or silicates, or most salts or oxides of the alkalies or alkaline earths, or of Zinc; Chlorides of Mercury, Silver, Lead; Carbonates of Lead, Bismuth; very many organic substances, &c.

The foregoing tables, I. to IX., form a suitable method for the "preliminary examination" of all substances, previous to their detailed analysis, whether natural or artificial, inorganic or organic.

It is seldom, however, that the nature of a substance is *altogether* unknown, and with the limited number of minerals in the district under consideration, a great deal of time may often be saved by using the following scheme, in which the minerals are grouped solely in accordance with their most evident characters, and those the least likely to be misunderstood.

Sometimes a mineral appears in two or more groups, so as to afford a greater chance of its recognition; nevertheless, to ensure success, the characters of a specimen should be compared with those of the groups in their order.

TABLE X.—MINERALS OF CORNWALL AND DEVON, ARRANGED IN GROUPS FOR CONVENIENCE OF IDENTIFICATION.

GROUP I.—PULVERULENT.

(Occurring in soft earthy masses, or as a powdery coating on other minerals.)

Name.	Colour.	Behaviour on Charcoal B. B.	In Borax Bead.	Remarks.
Black Sulphuret of Silver.	Black.	Easily reduced to a bright white bead of silver.	—	Very rare indeed. See Argentite, p. 9.
Condurrite.	Do.	Easily reduced to a bead of copper, with strong alliaceous odour.	Green OF, red & opaque RF.	Very rare & local. See Domeykite, p. 42.
Melaconite.	Do.	Easily reduced to a bead of copper, *without* alliaceous odour.	Do.	Not uncommon in copper mines.
Asbolane.	Do.	Infusible.	Blue, both OF and RF.	Very rare & local.
Wad.	Do.	Do.	Amethystine OF, colourless RF.	Local, but not very rare.
Pyrolusite.	Do.	Do.	Do.	*Anhydrous*, only the *outer coating* pulverulent.
Red Ochre.	Red.	Do.	Reddish-yellow OF, bottle-green RF.	Common in some distarict. See Hematite, p. 55.
Umber.	Brown.	Do.	Do.	Do. See Limonite, p. 63.
Yellow Ochre.	Yellow.	Do.	Do.	Do. do.
Blue Iron Earth	Blue.	Fusible to a magnetic mass.	Do.	Local & rare. See Vivianite, p. 104.
Pittieite.	Yellow to brown.	Do.	Do.	Rather rare and very local.
Plumbic Ochre.	Yellow.	Easily reduced to a bead of lead.	—	Very rare.
Bismite.	Do.	Easily reduced to a bead of bismuth.	—	Very rare.
Cervantite.	Do.	Easily reduced to a brittle bead of antimony.	—	Not uncommon; but local.
Wolframite.	Do.	Infusible and not reducible.	—	Occurs as a coating on Wolfram. Local and rare.
Zippeite.	Yellow or grnsh-yel.	Do.	Green bead OF and RF.	Local and rare.
Langite.	Blue or greenish.	Easily reduced to a bead of copper.	Green OF, red & opaque RF.	Local and rather rare.
Annabergite.	Green.	Fusible, with strong alliaceous odour.	—	Local and very rare.
Chlorite.	Dark green or blue.	Generally fusible to a magnetic mass.	Reddish-yellow OF, bottle-green RF.	Compact, massive very common. (Peach.)
Kaolin.	White.	Infusible; blue with Co.	—	Local; very common.
Magnesite.	Do.	Infusible; pink with Co. Sol. eff. with	—	Very doubtful as a Cornish or Devon species.
Mesolite.	Do.	Fusible to a white enamel; blue with Co.	—	Very rare and local.

GROUP II.—FOLIACEOUS.

(Occurring in thin leaves or scales; or may be easily split up into such with a penknife.)

Name.	Colour.	Behaviour on Charcoal B. B.	In Borax Bead.	Remarks.
Gilbertite.	White or yellowish	Infusible; blue with Co.	—	Local; chiefly in china clay districts.
Talc.	White or greenish.	Infusible; pink with Co.	—	Local; with serpentine.
Gypsum.	White, yellowish, or brownish	Infusible; fusible to a clear bead with Fluor Spar.	—	Local and rare; more often crystals with very easy cleav. than in thin plates.
Goethite.	Yellow or brown.	Infusible; hydrous.	Reddish-yellow OF, bottle-green RF.	More often in dark coloured crystals.
Hematite.	Red, brown black.	Infusible; anhydrous.	Do.	Do.
Brookite.	Brown.	Do.	Yel. hot, violet cold RF.	Exceedingly local and rare.
Molybdenite.	Lead grey.	Infusible; anhydrous; turns flame greenish.	—	Rare and local.
Graphite.	Do.	Infusible; anhydrous.	—	Do.
Marmolite.	Green.	Infusible; pink with Co.	—	Local; with common serpentine.
Muscovite.	Brown.	Difficulty fusible (about 4); blue with Co.	—	Often occurs in granite.
Schiller Spar.	Yellow to brown.	Difficulty fusible.	—	Occurs imbedded in serpentine.
Chlorite.	Green.	Difficulty fusible to a magnetic mass.	Reddish-yellow OF, bottle-green RF.	Very local in the foliated condition.
Lepidolite.	White or peach.	Fusible; tinges flame red if moistened with H_2SO_4.	—	The white mica in granite is chiefly Lepidolite.
Lepidomelane.	Brown or black.	Fusible to a magnetic mass.	Reddish-yellow OF, bottle-green RF.	The dark mica in granite is chiefly Lepidomelane.
Covellite.	Dark blue.	Fusible; easily reduced to a bead of copper.	Green OF, red and opaque RF.	Very rare.
Chalcophyllite.	Green.	Do.	Do.	Rare and local.
Torbernite.	Do.	Fusible; reduced with difficulty to a bead of copper on addition of soda.	Do.	Do.
Autunite.	Yellow.	Fusible.	—	Very rare & local.
Vivianite.	Green, blue or brown.	Fusible to a magnetic mass.	Reddish-yellow OF, bottle-green RF.	Rare and local.
Erythrite.	Pink.	Fusible; strong alliaceous odour.	Blue, both OF and RF.	Very rare & local.
Copper.	Red.	Fusible; malleable.	—	Occasionally found in thin leaves in the joints of serpentine and other rocks.
Gold.	Yellow.	Fusible; malleable.	—	Very rare; in stream works.

GROUP III.—CAPILLARY.

(Occurring in soft or flexible fibres.)

Name.	Colour.	Behaviour on Charcoal B. B.	In Borax Bead	Solubility.	Remarks.
Arsenolite.	White.	Readily fusible, strong arsenical odour, and white coating.	—	Slightly sol. in water.	Very rare.
Goslarite.	Do.	Readily fusible at first, then infusible; green with Co.	—	Soluble in water.	Do.
Kalinite.	Do.	Readily fusible at first, then infusible; blue with Co.	—	Soluble in water.	Rare & local.
Mesolite.	Do.	Fusible to a white enamel; blue with Co.	—	Soluble in HCl.	A doubtful species.
Natrolite.	Do.	Fusible; blue with Co.	—	Slowly sol. in HCl.	Extremely rare.
Tavistockite.	Do.	Do.	—	Do.	Do.
Asbestos.	Do.	Do.	—	Insol. in acids.	Local, rather rare.
Actinolite.	Green.	Fusible.	—	Do.	Local.
Silver.	White, often tarnished.	Malleable, fusible to a bead of Silver.	—	Soluble in HNO_3.	Very rare.
Cerussite.	Do.	Fusible; easily reduced to Lead.	—	Sol. eff. HCl.	Local, not rare
Melanterite.	Pale green.	Fusible at first, then infusible.	Reddish-yellow OF, bottle green RF.	Soluble in water.	Local, rather rare, a product of decomposition.
Aragonite.	White to red or grey.	Infusible, alkaline after heating.	—	Sol. eff. in HCl.	Very rare and local.
Gypsum.	White to brown.	Infusible; fusible with Fluor Spar to a white bead.	—	Insol. in acids.	Rare.
Chrysotile.	White to grey,	Infusible; pink with Co.	—	—	Occurs with serpentine in narrow veins
Prehnite.	Pale green.	Fusible; blue with Co.	—	Insol. in acids.	Very rare.
Annabergite.	Green.	Fusible; arsenical odours.	—	Green, sol. in HNO_3.	Do.
Atacamite.	Do.	Fusible; bright blue flame; bead of Cu.	Green OF, red and opaque RF.	Soluble in ammonia.	Do.
Olivenite.	Greenish-grey.	Fusible, strong arsenical odour; green flame.	Do.	Sol. HCl.	Rather rare now.
Connellite.	Blue.	Fusible, blue flame; bead of Cu.	Do.	HNO_3.	Very rare.
Pyromorphite	Green.	Fusible; crystallizes on cooling; with soda a bead of lead.	—	Do.	Not uncom. in lead mines in small hexag. prisms, *rarely* acicular.
Mimetite.	Yellow to brown.	Fusible; strong arsenical odour; bead of lead.	—	Do.	Do.
Cervantite.	Yellow.	Fusible; much white fume.	—	Sol. HCl.	Local, but not very rare.

GROUP III.—CAPILLARY *(Continued)*.

Name.	Colour.	Behaviour on Charcoal B. B.	In Borax Bead	Solubility.	Remarks.
Erythrite.	Pink.	Fusible; strong arsenical odours.	Blue, both flames.	HNO_3.	Rare.
Chalcotrichite	Red.	Easily reduced to a bead of copper.	Green OF, dark red and opaque RF.	Do.	Rare & local in this form. See Cuprite, p. 39.
Millerite.	Yellow and metallic.	Fusible; sulphureous odour, brittle bead.	—	Do.	Rare.
Bismuthinite.	Yellow or grey, and metallic.	Fusible; sulphureous odour; bead of Bismuth.	—	Do.	Do.
Antimonite.	Grey and metallic.	Fusible; much white fume.	—	HCl.	Local, not rare
Jamesonite.	Do.	Fusible; much white fume, and bead of lead.	—	Sol. in part.	Do.
Wittichenite.	Grey.	Fusible; bead of copper.	Green OF, dark red RF.	HNO_3.	A doubtful species.
Vivianite.	Green to brown.	Fusible to a magnetic mass.	Reddish-yellow OF, bottle green RF.	Do.	Rare.
Tourmaline.	Very dark green, brown, or black.	Do.	Do.	Insol.	Very common but not usually acicular.
Manganite.	Greyish-black, metallic.	Infusible.	Amethystine OF, colourless RF.	HCl.	Rare.
Pyrolusite.	Do.	Do.	Do.	Do.	Local but common, usually acicular.
Sulphur.	Yellow.	Combustible, blue flame.	—	Insol.	Very rare in Corn. or Dev.

GROUP IV.—SAPID.

(Soluble in water, and consequently having a distinct taste.)

Name.	Colour.	Taste.	Special Experiments.	Remarks.
Halite.	White or brownish.	Taste of common salt.	Precipitates Nitrate of Silver.	A doubtful Cornish or Devon species.
Goslarite.	White.	Nauseous, metallic.	With Co. green.	Very rare.
Arsenolite.	Do.	Sweetish.	Alliaceous odour on charcoal.	Very rare; entirely volatile.
Kalinite.	Do.	Sweetish, astringent.	Blue with Co.	Very rare.
Melanterite.	Pale green.	Nauseous, like ink.	With borax, iron reactions.	Local, but not uncommon.
Cyanosite.	Blue or greenish.	Very nauseous, metallic.	On charcoal a bead of Copper.	Not uncommon in copper mines.
Johannite.	Green.	Bitter, astringent.	With borax, Uranium reactions.	Very rare.

GROUP V.—MALLEABLE.

(May be beaten out into thin plates without breaking under the hammer.)

Name.	Colour.	Special Experiments.	Remarks.
Gold.	Yellow.	Insoluble in HCl or HNO_3; yellow solution in Aqua Regia.	Very rare.
Silver.	White, often tarnished.	Soluble in HNO_3; precipitated by HCl as a white curd, which is sol. in am.	Rare.
Copper.	Red.	Green solution in HNO_3.	Common.
Argentite.	Lead-grey.	On charcoal a bead of Silver.	Rare; only imperfectly malleable.
Chalcocite.	Do.	On charcoal a bead of Copper.	Common; only imperfectly malleable.
Bismuth.	Reddish-white.	Fusible on charcoal, a reddish-yellow coating.	Rather rare; only imperfectly malleable.
Molybdenite.	Lead-grey.	Infusible, tinges flame green.	Flexible, usually foliaceous; rare.
Kerargyrite.	Greyish.	Fusible, yields a bead of silver; sol. in ammonia.	Rare.

GROUP VI.—PLASTIC.

(May be moulded by the fingers, at least when wet.)

Name.	Colour.	Special Experiments.	Remarks.
Kaolin.	White.	Infusible; blue with Co.	Very common.
Chloropal.	Yellowish-green	Infusible; turns black and magnetic.	Not uncommon; associated with china clay.
Glauconite.	Green.	Fusible to a dark magnetic glass.	A doubtful Cornish or Devon species.
Smectite.	Brownish.	Infusible, or fusible to a dark magnetic glass.	Falls to powder if placed *in* water; a very doubtful species.
Saponite.	Greyish or yell.	Difficultly fusible.	See Steatite, p. 86.

GROUP VII.—BOTH COLOUR AND STREAK BLUE.

Name.	Behaviour on Charcoal.	Solubility.	Remarks.
Chessylite.	Readily yields a bead of copper.	Soluble *with eff.* in HCl.	Not uncommon in small quantities in cop. mines.
Clinoclase.	Strong alliaceous odours, and yields a bead of copper, more readily on addition of soda.	Soluble, except the arsenic, in HNO_3.	Rare; may be best known by the form of its crystals.
Liroconite.	Do.	Do.	Do.
Connellite.	Yields a bead of copper; strong sulphureous odour; bright blue flame.	Not readily soluble in acids.	Exceedingly rare; only a few specimens known.
Langite.	Yields a bead of copper, with sulphureous odour.	Do.	Rare; occurs as a powdery coating, or crystalline, on killas of copper lodes.

GROUP VII *(Continued)*.

Name.	Behaviour on Charcoal.	Solubility.	Remarks.
Demidoffite.	Infusible; *with soda* yields a bead of copper.	Slowly decomposed by HCl leaving gelatinous silica.	Extremely rare.
Linarite.	Fusible; yields a small grain of copper, and deposits a yellow coating of oxide of lead.	Insoluble in acids.	Extremely rare; the streak is very pale blue.
Chlorite.	Fusible to a magnetic bead.	Do.	Usually earthy or *foliaceous*, and often more or less green.
Blue Iron Earth.	Do.	Soluble in HCl.	Pulverulent; rare.

GROUP VIII.—BOTH COLOUR AND STREAK GREEN.

Name.	Behaviour on Charcoal.	Solubility.	Remarks.
Atacamite.	Easily reduced to a bead of copper; colours flame strongly blue.	Soluble in ammonia, colouring it strongly blue.	Very rare and local.
Brochantite.	Easily reduced to copper; sulphureous odour.	Soluble in HCl.	Rare and local.
Malachite.	Reduced to copper without fluxes.	Soluble with effervescence in HCl.	Common in cop. mines; streak very pale green.
Chrysocolla.	Reduced to copper only by addition of fluxes.	Slowly decomposed by HCl, leaving gelatinous silica.	Rare in copper mines; not uncommon in the Lizard district; streak very pale green.
Olivenite.	Fuses readily, sometimes deflagrates; gives off alliaceous fumes, and deposits an abundant white incrustation on the cool part of the support; with soda yields a bead of copper.	Soluble, except arsenic anhydride, in HNO_3; soluble in HCl, forming a green solution.	Local, but not very rare.
Chalcophyllite.	Do.	Do.	Rare; best known by the form of its crystals.
Clinoclase.	Do.	Do.	Rare and local; best distinguished from Olivenite by the form of its crystals; more often blue than green.
Liroconite.	Do.	Do.	Rare; only green occasionally; best distinguished by the form of its crystals.
Cornwallite.	Do.	Do.	Very rare; never in crystals.
Erinite.	Do.	Do.	Very rare; occurs in mammillated crusts.
Bayldonite.	Fuses readily, gives off alliaceous odours, and deposits a yellow coating near the assay; leaves a hard white alloy of copper and lead.	Soluble in warm HNO_3, but not readily; the solution yields a white ppt. of $PbSO_4$ on addition of sulphuric acid.	Very rare; occurs in minute mammillary concretions; grass-green to blackish-green.

GROUP VIII. *(Continued.)*

Name.	Behaviour on Charcoal.	Solubility.	Remarks.
Chenevixite.	Fuses readily to a black magnetic scoria; gives off arsenical fumes; with fluxes yields a grain of copper.	Readily soluble in HNO_3 or HCl, forming a green solution.	Very rare; occurs in small compact masses, imbedded in quartz.
Libethenite.	Fuses to a dark bead of metallic appearance; in RF with soda yields a bead of copper, but not readily.	Readily soluble in HNO_3, soluble also in HCl or ammonia; decomposed by KHO.	Rare and local.
Lunnite.	Do.	Do.	Only one British specimen known.
Torbernite.	Fuses to a dark mass, which crystallizes on cooling; with soda yields a bead of copper.	Soluble in HNO_3.	Local, but not rare, usually in very thin crystalline plates.
Pyromorphite.	Fuses readily, crystallizes on cooling; with soda yields a bead of lead, and coats the support yel.	Soluble in HNO_3, the solution yields a white ppt. on addition of H_2SO_4.	Not uncommon in lead mines; usually occurs in minute hexagonal prisms of a green colour; streak often uncoloured.
Pharmacosiderite.	Fuses readily to a black magnetic mass, giving off arsenical odours; with borax yields iron reactions.	Soluble in HNO_3 or HCl.	Rare and local; usually occurs in minute greenish cubes, variously modified.
Scorodite.	Do.	Do.	Very rare and local; usually occurs in slender prisms of a pale bluish-green colour; streak nearly colorless.
Vivianite.	Fuses readily to a dark magnetic mass, which yields iron reactions with borax.	Do.	Local, but sometimes not uncommon; very variable in colour, but powder always blue after a little exposure.
Cronstedtite.	Fuses to a magnetic mass; with borax yields iron reactions.	Slowly decomposed by HCl, leaving gelatinous silica.	Very rare and local.
Annabergite.	Fuses readily, giving off strong alliaceous odours with borax yields nickel reactions.	Soluble in HCl or HNO_3, forming a clear green solution.	Local and rare.
Chlorite.	Fusible to a magnetic bead	Insoluble in acids.	Com., but usually earthy.

GROUP IX.—COLOUR AND STREAK RED, YELLOW, OR BROWN.

Name.	Hardness.	Streak.	Behaviour on Charcoal.	Solubility.	Remarks.
Cervantite.	Soft.	Yellow.	Volatile OF; reduced to a bead of antimony RF.	Sol. in HCl, sometimes re-precip. on addition of water.	Local, but not very rare.
Bleinierite.	2·0-4·0	Do.	Fuses readily to a grey brittle globule with sulphureous odour.	Sol. in strong HCl, giving off H_2S.	Do.

GROUP IX. *(Continued.)*

Name.	Hardness.	Streak.	Behaviour on Charcoal.	Solubility.	Remarks.
Pharmacosiderite.	2·5	Pale brown to green.	Fuses readily to a dark magnetic mass, giving off alliaceous odours; with borax yields iron reactions.	Sol. in HCl or HNO_3.	Rare & local, usually in small *greenish* cubes.
Pitticite.	2·3	Yellow or brownish.	Do.	Sol. in HCl.	Local, but sometimes not very rare A product of the decomp. of other minerals in old works; never crystallized.
Goethite.	5-5·5	Do.	Infusible; with borax yields iron reactions.	Slowly sol. in HCl.	Loc., but not rare; occurs usually in dark brown bril. crystls.
Limonite.	Do.	Yellow or brown.	Do.	Do.	Very com., oft. radiated but never in crystals; *yel. ochre is soft.*
Anatase.	5·5-6	Pale brown.	Infusible; with borax yields titanium reactions.	Slowly sol. in concentrat. H_2SO_4; insol. in HCl or HNO_3.	Very rare & local.
Rutile.	Do.	Do.	Do.	Do.	Do.
Brookite.	Do.	Do.	Do.	Do.	Do.
Titanite.	5-5·5	Greyish or brownish.	Very slightly fusible.	Decomposed by HCl.	Do.
Olivenite.	3	Pale brown to green.	Fuses readily, and gives off alliaceous odours; with soda yields a bead of copper.	Sol. in HCl, & all except arsenic anhydide in HNO_3.	Local but not very rare.
Hisingerite.	3·5-4	Yellow to brown.	Fuses to a dark magnetic bead, but not readily.	Soluble, except silica, in HCl.	Local & rare.
Pyromorphite.	Do.	Pale brown.	Fuses readily to a bead which crystallizes on cooling; with soda yields a bead of lead.	Sol. in HNO_3, precip. by H_2SO_4.	Not uncom. in lead mines colr. usually *green*, streak *pale green.*
Autunite.	1-2·5	Yellow.	Fuses readily to a dark mass with crystalline surface	Sol. in HNO_3, forming a yellow solution.	Local & very rare; usually as yellow scales.
Blende.	3·5-4	Pale brown.	Infusible; decrepitates strongly; support often slightly coated with white.	Very slowly soluble in H_2SO_4, giving off H_2S.	Very com., and widely diffused.
Wolfram.	5-5·5	Dark brown.	Infusible, or difficulty fusible; decrepitates strongly.	Slowly decomposed by HCl, depositing yel. tungstic anhydride.	Loc., but not rare; usually imbedded in quartz or chlorite.

GROUP IX. *(Continued.)*

Name.	Hardness.	Streak.	Behaviour on Charcoal.	Solubility.	Remarks.
Retinite.	1-2·5	Pale brown.	Burns with a bright flame.	Partly sol. in alcohol or ether; insol. in acids.	In England found only at Bovey Tracey.
Cuprite.	3-5·4	Red or dark brown.	Easily reduced to a bead of copper.	Sol. in HNO_3, forming a green solution.	Common.
Hæmatite.	5·5-6·5	Do.	Infusible; magnetic; with borax gives iron reactions.	Slowly sol. in HCl.	Do.
Erythrite.	1·5-2·5	Pink.	Fusible readily; gives off alliaceous odours; with borax yields cobalt reactions.	Sol. in HCl or HNO_3.	Local & rare.
Pyrargyrite.	2-2·5	Dark red.	Fuses readily to a dark bead; after long roasting yields a bead of silver.	Decomp. by HNO_3, precipitated on addition of HCl.	Do.

GROUP X.—COLOUR VARIOUS, STREAK BLACK OR VERY DARK, H. BELOW 5.

(Easily scratched with a knife.)

Name.	Colour.	Streak.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Antimonite.	Lead-grey.	Black.	4·5-4·7	Readily fusible; volatile; sulphureous odour; white coating.	Soluble in warm HCl, gives off H_2S.	Common, but local.
Jamesonite.	Do.	Do.	5·5-5·8	Readily fusible; sulph. odour; yellow coating; bead of lead.	Soluble in HNO_3, precipitated by H_2SO_4.	Common, but local.
Antimony.	Tin-white.	Grey and shining.	6·6-6·8	Readily fusible & volatile; white coating.	Soluble in Aqua Reg.	A doubtful British species.
Arsenic.	Dark greyish.	Do.	5·9-6·0	Readily fusible & volatile; strong alliaceous odour.	Soluble in HCl.	Do.
Berthierite.	Grey or brown.	Dark grey or black.	4-4·3	Readily fusible to a dark magnetic slag; white coating; sulphureous odour.	Sol. in HCl, giving off H_2S.	Local, but probably not very rare.
Argentite.	Lead-grey.	Black, shining.	6·9-7·4	Readily fusible & reduced to a bead of silver.	Soluble in HNO_3, precipitd. by HCl, colorless solutn.	Local and rare; malleable.
Stephanite.	Black.	Black.	6·2-6·3	Readily fusible; white coating on support; bead of silver if treated with soda.	As Argentite, colorless solution.	Local and rare; brittle.

GROUP X. *(Continued.)*

Name.	Colour.	Streak.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Polybasite.	Black.	Black.	6·0-6·2	Readily fusible; white coating; bead of Ag. with soda.	As Argentite, green solution.	A doubtful British species.
Chalcocite.	Lead-grey.	Greyish-black.	5·5-5·8	Readily fusible; bead of copper; sulph. odour.	Decompsd. by HNO_3, green solution.	Common, but local.
Covellite.	Dark blue.	Black.	3·8-4·6	Readily fusible; combustible in part; bead of per; sulphureous odour.	As Chalcocite.	Local and rare.
Erubescite.	Purplish, mottled, or variegated.	Do.	4·4-4·5	As Chalcocite, but requires addition of borax for reduction; slag gives iron reactions.	Do.	Local, but not uncommon.
Chalcopyrite.	Yellow or variegated.	Greenish-black.	3·5-4	As Erubescite; but less easily reduced to copper; fused mass is magnetic.	Do.	Common.
Domeykite (Condurrite).	Greyish or brownish-black.	Black and shining.	4·5-7·5	Fuses readily; yields strong alliaceous odour & abundant white coating; reduced to a bead of cop.	Partially soluble in HNO_3, grn. solution.	Local and rare.
Tennantite.	Lead-grey to iron-black.	Dark reddish-brown	4·3-4·5	Fuses readily; strong alliaceous odour; white coating; bead of cop. with fluxes.	As Domeykite.	Local and rather rare, occurs usually in minute tetrahed. crystals.
Fahlerz.	Grey to iron-black often iridescent.	Dark reddish-brown or black.	4·5-5·2	Fuses readily; white coating; usually no alliaceous odour; bd. cop. with fluxes.	Very much as Tennantite.	Local, but not very rare.
Bournonite.	Lead-grey.	Greyish-black.	5·7-5·9	Fuses readily; sulphureous odour; yellow coating; bead of cop. with fluxes.	Partially sol. in hot HNO_3; a white ppt. on addition of H_2SO_4.	Local, but not very rare; very brilliant.
Stannite.	Greyish or black.	Black.	4·3-4·6	Fuses readily to a brittle magnetic bead; white coating; sulphureous odour.	Decompsd. by hot HNO_3, grn. solution.	Local, but not rare.
Wittichenite.	Tin-white to steel-grey.	Do.	4·3-5	Fuses readily; dark yellow coating; sulphureous odour; bead of copper with difficulty.	Soluble in hot HNO_3; white ppt. if diluted with much water.	A doubtful British species.

GROUP X. *(Continued.)*

Name.	Colour.	Streak.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Bismuthinite.	Lead-grey, often a yellow tarnish.	Black.	6·4-6·6	Fuses readily; dark yellow coating; sulphureous odour; brittle bead of bismuth.	Decompsd. by hot HNO_3 precipitated by water.	Local and rare; generally in brilliant needles.
Galena.	Lead-grey.	Do	7·2-7·7	Fuses readily; sulph. odour; bead of lead.	Decompsd. by hot HNO_3.	Common.
Pentlandite	Bronze-yellow or brownish.	Dark brown.	4·6	Fuses readily to a dark brittle magnetic mass; with borax yields iron reactions; sulph. odour.	Soluble in HNO_3, forming a greenish-yellow solution.	Local and rare.
Wolfram.	Dark greyish, or brownish-black.	Do.	7·7·6	Infusible, or fusible with great difficulty; decrepitates strongly.	Decompsd. by Aqua Regia, depositing yel. tungstic anhyd.	Local, but not rare usually; more than 5·0.
Manganite.	Greyish-black.	Dark brown or black	4·2-4·4	Infusible; Mn reactions with borax.	Soluble in warm HCl.	Local and rath. rare
Pyrolusite.	Bluish-black.	Black.	4·7-5·0	Do.	Soluble in warm HCl, giving off H_2S.	Local, but rather common; soils the fingers.

GROUP XI.—COLOUR VARIOUS; STREAK BLACK OR VERY DARK; H. FROM 5 TO 6.

(Scratched with a knife, but not easily.)

Name.	Colour.	Streak.	Sp. Gr.	Behaviour on Charcoal.	Borax Bead.	Remarks.
Chromite.	Brownish-black.	Brown.	4·4-4·5	Infusible.	Green both flames.	Local and rare, in grains imbedded in serp.
Cobaltite.	Tin-white or reddish.	Greyish-black.	6-6·3	Fusible to a dark brittle magnetic bead; alliaceous and sulphureous fumes.	Blue, both flames.	Local and rare.
Smaltite.	Greyish-black.	Black.	6·4-7·7	Fusible to a dark brittle magnetic bead; alliaceous odour and white coating.	Do.	Not uncommon.
Mispickel.	Tin-white to steel-grey.	Do.	6-6·3	Fuses readily to a dark brittle magnetic bead; alliaceous and sulph. odours; white coating.	Reddish-yellow OF, bottle-green RF.	Common in tin mines.

GROUP XI. *(Continued.)*

Name.	Colour.	Streak.	Sp. Gr.	Behaviour on Charcoal.	Borax Bead.	Remarks.
Leucopyrite	Tin-white, often a brown tarnish.	Black or greyish.	6·9-7·4	Fuses readily to a magnetic bead; strong alliaceous odours.	As Mispickel.	Not uncommon in tin mines.
Magnetite.	Dark brown or black.	Black.	4·9-5·2	Infusible.	Do.	Local and rather rare, often strongly magnetic.
Ilmenite.	Steel-grey or black.	Brown to black.	4·6-5·0	Do.	Yellow OF, brown RF.	Local, but not very rare.
Psilomelane	Greyish-black.	Brownish-black and shining.	5-6	Do.	Amethystine OF, colourless RF.	Local, not uncom.
Niccolite.	Copper-red	Brownish-black.	6·6-7·3	Fuses easily to a brittle globule; strong alliaceous odours.	Variable; reactions for *nickel* and *iron*.	Local and rare.
Wolfram.	Dark greyish or brownish-black.	Dark brown	7-7·6	Infusible, or fusible with great difficulty; decrepitates strongly, and separates into thin scales.	Reddish-yellow OF, darker on cooling.	Local, but not rare.

GROUP XII.—COLOUR VARIOUS; STREAK WHITE OR VERY LIGHT; H. BELOW 5.

(Easily scratched with a knife.)

Name.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Anglesite.	6·1-6·4	Fuses easily; sulphureous odour; bead of lead.	Infusible in acids.	Local and rare.
Cerussite.	6·4-6·5	Easily reduced to a bead of lead.	Soluble with effervescence in HCl or HNO_3.	Local, but not very rare, usually acicular.
Cromfordite.	6-6·3	Fuses easily to a white globule, which crystallizes on cooling; in RF a bead of lead and white coating.	Partly soluble with effervescence in HNO_3.	Only one Cornish specimen known to have occurred
Mimetite.	7-7·3	Fuses easily; strong alliaceous odour and bead of lead.	Partly soluble in HNO_3.	Local, but not uncommon in lead mines.
Pyromorphite.	6·5-7·1	Fuses easily; crystallizes on cooling; with borax yields a bead of lead, but not easily.	Do.	Not uncommon in lead mines.
Bismuth.	9·6-9·8	Very readily fusible; coats support yellow.	Soluble in HNO_3; precipitated on addition of water.	Local, but not very rare.

GROUP XII.—*(Continued.)*

Name.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Agnesite.	6·9-7	Very readily fusible; yellow coating; grey brittle bead of bismuth.	Soluble (with effervesc.?) in HNO_3; precip. on addition of water.	Local and very rare.
Valentinite.	5·5-5·6	Fusible and volatile; white coating, no alliaceous odour.	Soluble in Aqua Regia, re-precip. on addition of water if concentrated.	Local and rare.
Senarmontite.	5·2-5·3	Do.	Do.	Do.
Olivenite.	3·9-4	Readily fusible; strong alliaceous odour, white coating; bead of copper if treated with soda.	Soluble in HNO_3 except As_2O_3.	Local, but not very rare; streak usually very light green.
Pharmacosiderite.	2·9-3	Readily fusible; alliaceous odour, white coating; brittle magnetic slag which gives iron reactions.	Mostly soluble in HNO_3.	Local and rare; occurs usually in minute cubes of a green colour.
Scorodite.	3·1-3·3	Much like the preceding.	Do.	Local and rare; occurs usually in very light green prisms.
Vivianite.	2·6-2·7	Fuses readily to a dark magnetic bead; with borax yields iron reactions.	Do.	Local, but not very rare; streak soon becomes *blue*, though white at first.
Wavellite.	2·3-2·4	Fuses to a white opaque mass which turns blue when treated with Co.	Soluble in HCl and HNO_3.	Local, but not very rare, usually in *radiated* masses.
Natrolite.	2·2-2·3	Fuses readily, colours flame yellow, white residue, blue with Co.	Decomposed by HCl, leaving gelatinous silica.	Very rare.
Stilbite.	2·2·2	Do.	Do.	Do.
Asbestos.	2·9-3·4	Fusible, but not readily; usually turns blue with Co.	Insoluble in HCl.	Not uncommon in some districts.
Schiller Spar.	2·6-2·8	Fusible, but not readily; pinkish if treated with Co.	Decomposed by H_2SO_4, less readily by HCl.	Not uncommon in serpentine.
Serpentine.	2·4-2·6	Do.	Do.	Very common in some districts.
Agalmatolite.	2·4-2·9	Infusible; blue with Co.	Decomposed by warm H_2SO_4; scarcely acted upon by HCl.	Local, but not *very* rare.
Chiastolite.	2·9-3·4	Do.	Insoluble in HCl or HNO_3.	A doubtful Cornish species.
Pinite.	2·7-2·9	Infusible, or fusible with great difficulty; blue with Co.	Slightly acted on by HCl.	Local, but not uncommon.
Allophane.	1·8-1·9	Do.	Decomposed by HCl.	Local and rare.
Schrotterite.	1·9-2·1	Infusible, or fusible with great difficulty; blue with Co.	Decomposed by HCl.	A doubtful Cornish species.
Steatite.	2·2-2·8	Infusible; pink or red with Co.	Scarcely affected by HCl, decomposed by H_2SO_4.	Local, but not uncommon.
Talc.	2·6-2·8	Do.	Do.	Do.

GROUP XII. *(Continued.)*

Name.	Sp. Gr.	Behaviour on Charcoal.	Solubility.	Remarks.
Magnesite.	2·8-3·1	Infusible; pink with Co.	Soluble with effervescence in HCl.	A doubtful Cornish species.
Blende.	3·9-4·2	Infusible; decrepitates strongly; sulphureous odours, often white coating, which turns green with Co.	Soluble in strong HCl or HNO_3; gives off H_2S.	Very common.
Calamine.	4-4·5	Infusible; green with Co.	Soluble with effervescence in HCl.	Local and rare.
Calcite.	2·5-2·8	Infusible; glows with a bright light; becomes alkaline.	Soluble with effervescence in dilute HCl.	Not uncommon.
Aragonite.	2·7-3·0	As Calcite, but falls to powder at a low temperature.	Do.	Very rare and local.
Dolomite.	2·8-3·1	Infusible; becomes alkaline.	Do.	Not uncommon.
Chalybite.	3·7-3·9	Infusible, but turns black and magnetic.	Slowly soluble in HCl, with effervescence.	Very common.
Barytes.	3-4·7	Fusible at about 3; tinges flame yellowish-green.	Insoluble in HCl until after heating in R.F.	Local, but not very rare.
Celestite.	3·8-4	Fusible at about 3 to a white mass; if moistened with HCl colours flame bright red.	Do.	Local and rare.
Chrysocolla.	2·2-2·3	Infusible; with soda effervesces and yields a bead of copper.	Soluble in HCl, leaving gelatinous silica.	Local, but not very rare.
Chloropal.	1·7-2·1	Fusible with difficulty or infusible; turns black and magnetic.	Decomposed by HCl, leaving gelatinous silica.	Do.
Churchite.	3·0-3·1	Infusible; becomes opaque.	—	Very rare.

GROUP XIII.—COLOURS VARIOUS; STREAK WHITE OR VERY LIGHT;

H. FROM 5 TO 6.

(Scratched with a knife, but not easily.)

Name.	Sp. Gr.	Matrass.	On Charcoal.	Solubility.	Remarks.
Natrolite.	2·2-2·3	Yields water.	Fuses readily; colours flame yellow, white residue; blue with Co.	Decomp. by HCl, leaving gelatinous silica.	Very rare.
Analcite.	2·0-2·3	Do.	Do.	Do.	Of very doubtful occurrence.
Childrenite.	3·2	Do.	Infusible; with borax yields iron reactions.	Slowly sol. in HCl.	Local and rare.
Porcellanite.	2·6-2·8	Do.	Fuses with some difficulty; blue with Co.	Slightly acted upon by HCl.	Of very doubtful occurrence.

GROUP XIII. *(Continued.)*

Name.	Sp. Gr.	Matrass.	On Charcoal.	Solubility.	Remarks.
Babingtonite.	3·3-3·5	Anhydrous.	Fusible; alkaline reaction after heating; with borax iron reactions.	Insoluble in HCl or HNO_3.	Local, but not very rare.
Amphibole.	2·9-3·4	Do.	Often fusible to a dark magnetic mass.	Do.	Not uncommon; often green and radiated.
Pyroxene.	3·2-3·5	Do.	Do.	Do.	Local, but not very rare.
Orthoclase.	2·6	Do.	Fusible with difficulty, or infusible.	Do.	Common in granite; cleavages at right angles.
Albite.	2·6-2·7	Do.	Fusible; colours flame strongly yellow.	Do.	Probably not uncommon in granite; cleavage inclined.
Scapolite.	2·6-2·8	Do.	Fusible; blue with Co.	Do.	Local and rare.
Saussurite.	2·7-3·4	Do.	Fusible with difficulty, or infusible.	Do.	Local, but not rare.
Apatite.	3·2-3·3	Do.	Fuses with difficulty, or infusible.	Slowly sol. in HCl or HNO_3.	Local and rare.
Titanite.	3·4-3·6	Do.	Do.	Decomposed by HCl or HNO_3.	Do.
Scheelite.	5·9-6·2	Do.	Do.	Soluble, except *yellow* tungstic anhydride, in HCl.	Do.
Rhodonite.	3·4-3·7	Do.	Do.	Soluble, except silica, in HCl.	Local, but not rare.

GROUP XIV.—COLOURS VARIOUS; H. = 6 AND UPWARDS.

(Cannot be scratched with a knife.)

Name.	Hardness.	Sp. Gr.	Common Colours of Cornish or Devonshire specimens.	Remarks.
Quartz.	7	2·5-2·8	Often colourless, or white and opaque; sometimes tinged purple (*Amethyst*), yellow (*False Topaz*), or brown; rarely green.	Very common; best known by its hardness, want of cleavage, and insolubility in all acids except HF; often crystallized in hexagonal prisms.
Calcedony.	6-7	2·6	Often bluish or yellowish; sometimes white and opaque on the outside, and nearly black within.	Much less common than quartz; usually botryoidal or stalactitic; never crystallized; usually translucent, but not transparent.
Jasper.	6-7	2·6 3	Usually red, brown, or black, sometimes dark green.	Not very rare; never crystallized; nearly or quite opaque.

GROUP XIV. *(Continued.)*

Name.	Hardness.	Sp. Gr.	Common Colours of Cornish or Devonshire specimens.	Remarks.
Saussurite.	6	2·7-3·4	Usually greenish or reddish.	Local, but not very rare; in Britain not known out of the Lizard district.
Orthoclase.	6	2·5-2·6	Usually pale flesh-coloured; pink or red sometimes.	Very common in granite; best known by its perfect rectangular cleavages.
Albite.	6-7	2·6-2·7	Usually white or cream-coloured.	Less common than Orthoclase; cleavages make angles of 93° 36′ and 86° 24′.
Amphibole.	5-6	2·9-3·4	Usually dark green.	Common in a massive condition; rarely crystallized; fusible more or less readily.
Pyroxene.	4-6	3·2-3·3	Mostly dark green or nearly black.	Usually massive; much less common than Amphibole: reported from St. Just, but it is doubtful whether the typical variety has occurred in Cornwall or Devon.
Hypersthene.	4-6	3·2-3·6	Mostly dark brown.	Reported from the Lizard district, but it is doubtful whether true Hypersthene has been found there.
Opal.	5·5-6·5	1·9-2·3	Mostly of light colours.	Local and rather rare; never crystallized; yields water in matrass, and is partially soluble in KHO.
Isopyre.	5·5-6·5	2·9-3·0	Usually dark brown or nearly black.	Local and rare; not known to crystallize; somewhat vitreous in appearance.
Rhodonite.	5-6	3·4-3·7	Usually pink or rose-red.	Local, but not very rare, in a massive condition; fusible with a strong heat, and yields manganese reactions.
Tourmaline.	7-7·5	2·9-3·3	Usually black, dark brown, or dark green.	Common; usually in indistinct prisms, or radiated masses.
Garnet.	6·5-7·5	3·1-4·3	Usually brown or brownish-yellow.	Local and somewhat rare; occurs in crystals like Figs. 3, 5, 19, 25, 26.
Axinite.	6·5-7	3-3·3	Brownish.	Best known by its unsymmetrical, sharp-edged, brilliant, tabular crystals; local and somewhat rare.
Anatase.	5·5-6	3·8-4	Mostly brownish; lustre semi-metallic.	Local and rare; best known by the form of its crystals, see Figs. 72, 73, 234; with borax yields titanium reactions.
Brookite.	5·5-6	4-4·2	Brownish; thin plates reddish; lustre semi-metallic.	Local and very rare; crystals like Fig. 147; with borax like Anatase.
Rutile.	5·5-6	4·2-4·3	Brownish or reddish; lustre semi-metallic.	Local and very rare, or doubtful; with borax like Anatase.
Cassiterite.	6·7	6·8-7	Greyish, brownish, or black; lustre semi-metallic.	Common; easily known by its hardness and high specific gravity.
Pyrites.	6-6·5	4·8-5·1	Yellow; lustre metallic.	Common; often occurs in cubes or pentagonal dodecahedrons.
Marcasite.	6-6·5	4·8-5·1	Do.	Not so common as Pyrites, best distinguished by the different form of its crystals.
Braunite.	6-6·5	4·7-4·8	Black or dark-grey; lustre metallic.	Very doubtful as a British species; with borax yields manganese reactions.

GROUP XIV. *(Continued.)*

Name.	Hardness.	Sp. Gr.	Common Colours of Cornish and Devonshire specimens.	Remarks.
Chondrodite.	6-6·5	3·1-3·2	—	Very rare, if not doubtful; occurs in small, highly modified imbedded crystals.
Topaz.	8	3·4-3·6	Colourless, or slightly tinted with blue, green, or yellow.	Local and very rare; in longitudinally striated prisms, with Cassiterite, Apatite, Fluor, or Quartz.
Beryl.	7·5-8·0	2·6-2·8	Colourless, or slightly tinted with green or blue.	Local and very rare, as hexagonal prisms, imbedded in Granite.
Prehnite.	6-7	2·9-3	Usually pale green.	Local and very rare; fusible with effervescence at about 3.
Epidote.	6·5	3-3·5	Usually green or brown.	Local and very rare: fusible more or less readily; occurs imbedded in Quartz or on Hornblende rock.
Andalusite.	7-7·5	2·9-3·4	Usually dull white or greyish.	Local and very rare; occurs in square prisms.
Staurolite.	7-7·5	3·4-3·8	Usually reddish-brown or black.	Local and very rare, if not doubtful.

GROUP XV.—COLOUR VARIOUS; COMBUSTIBLE OR VOLATILE.

(If heated on Charcoal, burn away or pass off in vapour.)

NOTE.—*Many sulphides take fire momentarily, but they always leave a considerable quantity of incombustible matter.*

Name.	Colour.	Sp. Gr.	Solubility.	Remarks.
Bitumen.	Dark brown or black.	1-1·2	Partly soluble in ether or alcohol.	Local and rare; usually more or less plastic.
Retinite.	Brown or yellowish-brown.	1-1·2	Do.	Local, not very rare; brittle; found only at Bovey Tracey.
Arsenic.	Dark steel grey.	5·9-6·0	Soluble in HCl.	A doubtful species.
Arsenolite.	White, or pale yellow.	3·6-3·7	Do.	Local and rare; completely volatile.
Graphite.	Lead-grey or black.	1·8-2·0	Insoluble in acids.	Local and rare; burns away slowly without flame.
Sulphur.	Yellow.	2-2·1	Do.	Local and very rare; burns with sulphureous odour.
Pigotite.	Brown.	—	Partly soluble in HCl.	Local, but probably not very rare.

CHAPTER III.

DESCRIPTIVE.

A full description of a mineral would involve a knowledge of *all* its properties, as well as the conditions of its occurrence and the mode of its formation. In this sense no mineral has yet been described; perhaps never will be. In the second part of this work I have endeavoured to indicate by the type in which the name is printed the comparative abundance or rarity of the minerals described. Thus, very common minerals, as **PYRITES**; minerals which are less common, as CALCITE; and those which may be regarded as rare, as *OLIVENITE*, are at once indicated by their type. A further distinction had been intended for the *very* rare ones, as TOPAZ, but by an oversight this was neglected until too late.

The characters of the minerals are then given, as far as possible in the following order:—

Synonyms,	Frangibility,	Streak,
Form,	Diaphaneity,	Phosphorescence,
Cleavage,	Lustre,	Hardness,
Structure,	Colour,	Specific Gravity.

The best marked varieties are then described (*Var.*), after which the chief blowpipe and chemical reactions are indicated (*B., etc.*). The chemical composition (*Comp.*) is next given, together with all the analyses of specimens from Cornwall or Devon which the author has been able to procure. In most cases *formulæ* of several kinds are added in accordance with a *theoretical composition*. The atomic weight and symbols used in the formulæ are given in a "Table of the Elements," which closes this chapter. The localities (*Loc.*) are then stated as fully as possible, and certainly much more so than in any work previously issued. Especial care has been taken to avoid errors in this respect; and it is believed that although there may be many omissions, very few of the localities stated are erroneous. In the West of Cornwall many are given from the author's personal knowledge. Next, a general indication of the extent of the distribution of the species is given; then, often some simple means of distinguishing it from minerals which it somewhat resembles, and mention is made of the minerals or rocks with which it is especially associated. A table of the angles of the crystals, with reference to the figures in Plates 1 to 10, is then given, for which the author is mostly indebted to Messrs. Greg and Lettsom's Manual of the Mineralogy of Great Britain and Ireland, with occasional aid from Brooke and Miller, Dana, and Nicol.

In future discoveries of minerals the author would suggest to the discoverers that they should particularly observe the minerals with which the specimens are associated, and, if first seen *in sitâ*, that they should carefully observe the position of the *crystals*, with reference to the "foot-wall," "hanging-wall," or "back" of the lode, or the "joints" of the quarry.

In some instances the names given to minerals have reference, either to some supposed peculiarity of the species, or of its mode of occurrence. I therefore give a list of those which occur in the district under consideration, with short remarks upon each.

NOMENCLATURE OF MINERALS OCCURRING IN CORNWALL OR DEVONSHIRE.

(NAMES OF VARIETIES IN ITALICS.)

Actinolite. Gr. *Actinotos*, radiated; *lithos*, a stone.

AGALMATOLITE. (Gr. *Agalma*, an image; *lithos*, a stone.) Figure-Stone. So called because it is carved into figures by the Chinese.

Agate. Named from its occurrence near the river Achates, in Sicily.

AGNESITE. So called because it was found at St. Agnes, Cornwall.

ALBITE. (Lat. *Alba*, white.) First described by Wallerius, in 1747.

ALLOPHANE. (Gr. *Allos*, different; *phaino*, I appear.) First described by Stromeyer, in 1816.

Amethyst. (Gr. *A*, priv.; *methystos*, drunkard.) From its supposed virtue of preventing intoxication.

Amianthus. (Gr. *A*, priv.; *miaino*, to soil.) In allusion to the method of cleaning fabrics made of this mineral by fire.

AMPHIBOLE. (Gr. *Amphibolos*, doubtful or ambiguous.) In allusion to the resemblance of the different varieties, or sub-species, to those of *Pyroxene*. First described as a variety of Schorl, by Wallerius, 1747.

ANALCITE. (Gr. *A*, priv.; *alkimos*, strong; *lithos*, a stone.) Discovered by Dolomieu, at Etna, in 1784; named by Gallitzin, in 1801, in allusion to its feeble electric properties.

ANATASE. (Gr. *Anatasis*, stretching forth.) First described by Romé de l'Isle, in 1783, as a variety of Schorl; named Anatase by Hauy, in 1801, in allusion to the frequent lengthened form of the pyramids.

ANDALUSITE. First described (a specimen from Forez) in the "Journal de Physique," in 1789; named Andalusite, by Delameth, in the same journal, 1798, from its frequent occurrence in Andalusia.

ANGLESITE. First described by Monnet, in 1779; named by Beudant, in 1832, from its occurrence in the Isle of Anglesea.

ANNABERGITE. First described by Cronstedt, in 1758; named by Brooke and Miller, in 1852, from its occurrence at Annaberg.

ANTHRACITE. Gr. *Anthrax*, carbon.

ANTIMONITE. First described by Basil Valentine (who proved it to contain sulphur) in 1430; named Antimonite, by Haidinger, in 1845.

ANTIMONY. Described Vet-Academineus, Stockholm, 1748.

APATITE. (Gr. *Apatao*, I deceive.) First mentioned as a variety of Aquamarine, by Brunnick, in 1770, and as a variety of Chrysolite, by Romé de l'Isle, 1772; named by Karsten, in the year 1800, in allusion to its great resemblance to many other minerals.

ARAGONITE. First described by Davila, 1767; defined, separated from Calcite, on account of its crystallization, and named by Hauy, in 1801, from its occurrence in Aragon.

ARGENTITE. (Lat. *Argentum*, silver.) First described by Agricola, 1529; named by Haidinger, in 1845.

ARSENIC. Gr. *Arsenikon*, masculine.) In allusion to its very strong and well-defined properties.

ARSENOLITE. First described by Wallerius, in 1747; named and defined by Dana, in 1854.

Asbestos. Gr. *A*, priv.; *sbestos*, combustible.

ASBOLANE. (Gr. *Asbolaino*, I soil like soot.) First observed in 1529; named by Breithaupt, in 1847.

ATACAMITE. First described by Rochefoucauld, Baumé, and Fourcroy, in 1786; named by Blumenbach, in allusion to its occurrence in the desert of Atacama, in 1805.

Augite. Gr. *Auge*, lustre.

AUTUNITE. Described as a variety of Uranite, before 1819, by several authors; named by Brooke and Miller, in 1852, in allusion to its occurrence at Autun.

AXINITE. (Gr. *Axine*, an axe.) First described as a species of Schorl, by Schruber, in 1781; named by Hauy, in 1779, in allusion to the common form of its crystals.

Babel Quartz. Named, in allusion to the successive stories of which it is built up, after the Tower of Babel.

BABINGTONITE. First described by Levy, in 1824, and named after Dr. Babington.

BARYTES. (Gr. *Barus*, heavy.) First described by Licetus, in 1640; named *Barytite* by Delameth, in 1797, in allusion to its high sp. gr.

BAYLDONITE. First described and named after Dr. Bayldon, by Professor Church, in 1865. Found as yet only in Cornwall.

BERAUNITE. Named by Breithaupt, in 1841, from Beraun, in Bohemia.

BERTHIERITE. Described by Berthier, in 1827, and named Haidingerite; named by Haidinger, in the same year, after Berthier.

BERYL. Described by Theophrastus and other ancient writers; defined by Vauquelin, in 1800.

BISMITE. Separated from Bismuthite by Dana, 1868.

BISMUTH. Described by Agricola, 1546.

BISMUTHINITE. First described by Cronstedt, 1758; named Bismuthine, by Beudant, 1832; named Bismuthinite, by Dana, 1868.

BITUMEN. Mentioned by Pliny.

BLEINIERITE. Named Blei-Niere, by Karsten, 1800, thus signifying Lead-Kidney-ite. Dana proposes to name it after Bindheim, its first analyst.

BLENDE. Described by Agricola, in 1546; named *Blände*, by Wallerius, in 1747.

BOURNONITE. First described by Rashleigh, 1797, having been discovered in Cornwall; named after its discoverer, Comte de Bournon, by Jameson, in 1816.

BRAUNITE. First described and named after M. Braun, of Gotha, by Haidinger, in 1826.

BROCHANTITE. Named and described by Levy, in 1824, after Brochant de Villiers. Found in Cornwall about the year 1864.

BROOKITE. First described by Soret, 1822; named by Levy, in 1825, after the British mineralogist, H. J. Brooke.

CALAMINE. First described by Agricola, in 1546; separated from the Silicate of Zinc, and named Smithsonite, by Beudant, 1832.

Calcedony. Named Chalcedonius, by Agricola, in 1546.

CALCITE. Named Kalchstein (Limestone), by Agricola, in 1545; Calcite, by Haidinger, 1845.

CASSITERITE. (Gr. *Kassiteros*, tin.) Named Cassiterit, by Beudant, in 1832.

CELESTITE. First described by Schutz, in 1791; named from *Cœlestis*, *celestial* from a faint shade of blue often present, by Werner, 1798.

CERUSSITE. Named *Ceruse*, by Beudant, in 1832, from the *Cerussa* (artificial Carbonate of Lead) of Pliny and Agricola.

CERVANTITE. Defined and named, by Dana, in 1854, from Cervantes, in Galicia, Spain.

CHALYBITE. (Gr. *Chalybs*, iron.) Named by Glocker, in 1847.

CHENEVIXITE. Named by Adam, after the celebrated chemist, Chenevix, who published its first analysis. Found only in Cornwall.

CHESSYLITE. Described by Wallerius, in 1747; named by Brooke and Miller, in 1852, from its chief locality, Chessy, in France.

CHILDRENITE. Named by Levy, in 1823, after the celebrated mineralogist Children.

CHLORITE. (Gr. *Chloros*, *green*.) Name very ancient.

CHLOROPAL. Named by Bernhardi and Brandes, in 1822.

CHONDRODITE. (Gr. *Chondros*, a grain.) First described and named by d'Ohsson, in 1817.

CHROMITE. (Chrome-Stone.) First described by Vauquelin, in 1800; named thus by Haidinger, in 1845.

CHRYSOCOLLA. (Gr. *Chrysos*, golden; *colle*, glue.) Named thus by Agricola, in 1546.

CHURCHITE. Named by C. G. Williams, in 1865, after its first analyst, Prof. A. H. Church; discovered by Mr. Talling, of Lostwithiel, about 1865, and not yet found out of Cornwall.

CLINOCLASE. (Gr. *Klino*, to incline, and *klao*, to cleave.) First described by Klaproth, in 1801, in allusion to its inclined cleavages. Named thus by Breithaupt, in 1830.

COBALTITE. (Ger. *Kobold*, a mine-demon.) First described by Cronstedt, in 1758; named Cobaltine, by Beudant, in 1832.

CONNELLITE. First described by Rashleigh, in 1802; named by Dana, in 1850, after its first analyst, Connell. Not hitherto found out of Cornwall.

COPPER. (Lat. *Cuprum*.) A corruption of Cyprium, whence it was anciently brought.

CORNWALLITE. First described and named by Zippe, in 1845, from its occurrence in Cornwall. Not found elsewhere.

COVELLITE. Described by Breithaupt, in 1817; named by Beudant, after its discoverer, Covelli, in 1832.

CROMFORDITE. Described as Hornblei, by Karsten, in 1800; named by Greg and Lettsom, in 1858, from its occurrence at Cromford, in Derbyshire.

CRONSTEDTITE. First described and named by Steinmann, in 1821, after the Swedish mineralogist, Cronstedt.

CUPRITE. (Lat. *Cuprum*.) Named thus by Haidinger, in 1845.

CYANOSITE. (Gr. *Kuanos*, blue.) Named Cyanose, by Beudant, in 1832.

DEMIDOFFITE. Named after Demidoff, by Nordensk, in 1856. Dana regards it as a variety of Chrysocolla.

DIALLOGITE. Named Dialogite, by Jasche, in 1817.

DOLOMITE. Named Dolomie by Saussure, in 1796, after the celebrated Dolomieu, who first called attention to some of its peculiar properties, in 1791.

DOMEYKITE. First described by Zinken, in 1837; named by Haidinger, in 1845, after the celebrated mineralogist, Domeyko.

EPIDOTE. Described by de l'Isle, in 1783, as a variety of Schorl; named Epidote, by Hauy, in 1801.

ERINITE. Named by Haidinger, in 1828, from its supposed occurrence in Ireland, but shewn by Professor Church to be a Cornish species.

ERUBESCITE. First described by Henckel, in 1725; named Erubescite, by Dana, in 1850.

ERYTHRITE. (Gr. *Eruthros*, red.) First described by Brückmann, in 1727; named Erythrine, by Beudant, in 1832.

FAHLERZ. (Ger. *Fahl*, ash-coloured; *erz*, ore.) First described by Wallerius, in 1747, and named by him Falerts.

Felspar. (Ger. *Feldspath*, rock-spar.) A very ancient name.

FLUELLITE. First described and named from the presence of Fluorine, by Levy, in 1824. Not found out of Cornwall.

FLUOR. (Lat. *Fluere*, to flow.) First described and the name applied by Agricola, in 1529, in allusion to its value as a flux.

GALENA. (Gr. *Galeo*, I shine.) First named and described by Agricola, in 1546.

GARNET. (Fr. *Grenat*, a grain.) Described as a variety of *Anthrax*, by Theophrastus; named Granat, by Wallerius, in 1747.

GILBERTITE. Named and described, by Thomson, Min. I., p. 236.

GLAUCONITE. (Gr. *Glaucos*, bluish-green.) First described and named, by Keferstem, in 1828.

GOLD. A very ancient name.

GOSLARITE. First described by Agricola, in 1546; named by Haidinger, from its first known locality, *Goslar*, in 1847.

GRAPHITE. (Gr. *Grapho*, I write.) Described by Bromell, in 1739; named *Graphite*, by Werner, in 1789.

GYPSUM. (Gr. *Gypsos*, lime.) Described by Herodotus and Theophrastus. (325 B.C.) Named Gypsum, by Agricola, in 1546.

HALITE. Named by Glocker, in 1847.

HEMATITE. (Gr. *Haima*, blood.) Described by Theophrastus (325 B.C.), and named *Aimatites*.

HISINGERITE. First described and named by Berzelius, in 1828.

HYPERSTHENE. (Gr. *Hyper*, above, or excess; *sthenos*, strength.) First described as *Labrador Hornblende*, by Werner, in 1789; named by Hauy, in 1803.

ILMENITE. First described and named Menachanite, by Wm. McGregor, in 1791; named Ilmenite, by Kupfer, in 1827; re-named Menaccanite, by Dana, in 1868.

ISOPYRE. (Gr. *Isos*, equal, and *Pyr*, fire.) First described and named by Turner, in 1827.

JAMESONITE. First described by Jameson, in 1820; named after him, by Haidinger, in 1823.

JASPER. A very ancient name.

JOHANNITE. Discovered, by John, in 1821; named after him, by Haidinger, in 1830.

KALINITE. Known as alum for a very long period; named by Dana, in 1868.

KAOLIN. Described by Werner, in 1780; the name is Chinese.

KERATE. (Gr. *Keras*, a horn.) Described by Gesner, in 1565; named by Haidinger, in allusion to its *horny* nature, in 1845.

LANGITE. First described by Maskelyne, and named after Dr. Lang, in 1864.

LEPIDOLITE. (Gr. *Lepis*, a scale.) First described by Von Born, in 1791; named by Klaproth, in 1794.

LEPIDOMELANE. (Gr. *Lepis*, and *melas*, black.) Described and named by Hausmann, in 1840.

LEUCOPYRITE. (Gr. *Leucos*, white, and pyrites.) First described by Jameson, in 1820; named by Shepard, in 1835.

LIBETHENITE. Described by Leonhardt, in 1812; named by Breithaupt, in allusion to its chief locality, *Libethen*, in 1823.

LIMONITE. Described very anciently. Separated from Hematite and named, by Beudant, in 1832, from *Leimon*, a meadow; more particularly applicable to *Bog Iron Ore*.

LINARITE. First described, and named from its first locality, Linares, in Spain, by Brooke, in 1822.

LIROCONITE. (Gr. *Leiros*, pale, and *konis*, dust.) First described by Bournon, in 1801; named by Mohs, in allusion to its pale streak, in 1822.

LUNNITE. First described by Klaproth, in 1801; named by Bernhardi, in 1844.

MAGNESITE. Described by Werner, in 1803; named by Karsten, in 1808.

MAGNETITE. So named, from its magnetic properties, by Haidinger, in 1845. The mineral was known by the ancients.

MALACHITE. (Gr. *Malakos*, soft.) Included with Chrysocolla by Theophrastus; named Molochit, by Agricola, in 1546; Malachit, by Wallerius, in 1747.

MANGANITE. First described by De Lisle, in 1783; named Manganite, by Haidinger, in 1827, in allusion to the manganese contained in it.

MARCASITE. This name, which is of Moorish origin, was formerly applied to ordinary crystallized Pyrites. The present species was distinguished, and the name restricted, by Haidinger, in 1845.

MELACONITE. (Gr. *Melas*, black, and *konis*, powder.) First described by Werner, in 1789; named by J. N. Hust, in 1841.

MELANTERITE. (Gr. *Melas*, black.) Known to the ancients by the name *Melanteria*. Name adopted by Beudant, in 1832.

MESOLITE. First described by Fuchs and Gehlen, in 1816.

MILLERITE. First described by Werner, in 1789; named by Haidinger, in 1845, in honour of Dr. Miller, the eminent crystallographer.

MIMETITE. (Gr. *Mimetes*, imitator.) First described by Wallerius, in 1748; named Mimitese, by Beudant, in 1832, on account of the resemblance of its crystals to those of Pyromorphite; named Mimetit, by Haidinger, in 1844.

MISPICKEL. Described by Agricola, in 1546, as *Mist-puckel*; Mispickel, by Wallerius, in 1747. Name Arsenopyrite proposed by Dana, in 1868.

MOLYBDENITE. Included with Graphite by Wallerius, in 1747; named Molybdaena by the discoverer of its metallic base, Hielm, in 1782; Molybdenite, by Brongniart, in 1807.

MUSCOVITE. Named by Dana, in 1850, in allusion to its common occurrence in some parts of Russia (Muscovy).

NATROLITE. First described by Cronstedt, in 1758. Named by Klaproth, in 1803, in allusion to the soda (*natron*) contained in it.

NICCOLITE. First described by Hiärne, in 1694; named Nickeline, by Beudant, in 1832, in allusion to its contained metal; named Niccolite, by Dana, in 1868.

OLIVENITE. Discovered in Cornwall; first described by Klaproth, in 1786; named Olivenerz, by Werner, in 1789, in allusion to its olive-green colour; named Olivenite, by Jameson, in 1820.

OPAL. First described by Pliny.

ORTHOCLASE. (Gr. *Orthos*, straight, right; *klasis*, fracture.) Described by Agricola, in 1546. Separated from allied species, and named, by Breithaupt, in 1823, in allusion to its rectangular cleavages.

PENTLANDITE. Described by Scheerer, in 1843; named, by Dufrenoy, in 1856, after Mr. Pentland.

PHARMACOSIDERITE. (Gr. *Pharmakon*, poison, and *sideros*, iron.) Described by Kirwan, in 1796; named by Hausmann, in 1813, in allusion to its chemical composition.

PIGOTITE. In some Cornish caves; first discovered by Johnston (Phil. Mag., III., XVII., 382), and named after the Rev. Mr. Pigot.

PINITE. Described by Hoffmann, in 1789, and named from its occurrence in the galleries of the Pini Mine, at Schneeberg.

PITCHBLENDE. Described by Brückmann, in 1727; named Beckblände or Pitchblende, by Wallerius, in 1747. Name Uraninite proposed by Dana, in 1868.

PITTICITE. Described by Karsten, in 1808; named Pittizit, by Hausmann, in 1813.

PLUMBIC OCHRE. Described by Huot, in 1841, under the name of Massicot.

POLYBASITE. Described and named by H. Rose, in 1829, in allusion to its many contained bases.

PORCELLANITE. Described with allied species, by Ekeberg, in 1807; named by Von Kobell, in 1853; named Ekebergite, by Dana, in 1868.

PREHNITE. Described by Sage, in 1777, as Chrysolite; defined and named by Werner, in 1790, after Col. Prehn, who first found the mineral at the Cape of Good Hope.

PSILOMELANE. (Gr. *Psilon*, smooth; *melan*, black.) Described by Wallerius, in 1747; named by Haidinger, in 1827.

PYRARGYRITE. (Gr. *Pyr*, fire; *arguros*, silver.) Described by Agricola, in 1546; named by Glocker, in 1841.

PYRITES. (Gr. *Pyr*, fire; *ites*, for *lithos*, a stone.) Mentioned by Dioscorides and Pliny.

PYROLUSITE. (Gr. *Fyr*, fire, and *lusis*, decomposition.) Described by Cæsalpinus, in 1596; named and defined by Haidinger, in 1827.

PYROMORPHITE. (Gr. *Pyr*, fire, and *morphe*, form.) First described by Wallerius, in 1748; named by Hausmann, in 1813, in allusion to its ready crystallization after fusion.

PYROXENE. (Gr. *Pyr*, fire; *zeno*, a guest.) Mentioned by Wallerius, in 1747; defined by Démeste, in 1779; named by Hauy, in 1799, in allusion to its occurrence in volcanic regions.

PYRRHOTITE. (Gr. *Pyrrhotes*, reddish.) Mentioned by Wallerius, in 1747; named Pyrrotin, by Breithaupt, in 1835; Pyrrhotite, by Dana, in 1868.

QUARTZ. Described by Theophrastus, Pliny, and other ancient writers as Crystallos; mentioned as Quartz, by Wallerius, in 1747. Origin of name uncertain.

RETINITE. Occurs only at Bovey Tracey; described by J. Millès, in 1760; named by Hatchett, in 1804; named Retinellite, by Dana.

RHODONITE. (Gr. *Rhodon*, a rose.) Analysed and described by Ruprecht, in 1782; named by Jasche, in allusion to its red colour, in 1819.

RUTILE. (Lat. *Rutilus*, shining red.) Described as a variety of Schorl by de l'Isle, in 1783; named by Werner, in 1800.

SAUSSURITE. Described by Klaproth, in 1807; named by T. de Saussure, in 1806. Name Zoisite, of Brooke (1823), adopted by Dana, in 1868.

SCAPOLITE. (Gr. *Scapos*, a rod.) First described by de l'Isle, in 1783; named Scapolite, by d'Andrada, in 1800. Named and defined as Meionite, by Hauy, in 1801; name adopted by Dana, in 1868.

SCHEELITE. Referred to by Wallerius, in 1747; named Scheelit, by Leonhardt, in 1821, after the Swedish chemist, Scheele, who discovered Tungsten in this mineral in 1781.

SCHILLER SPAR. Described and named by Heyer, in 1786; included as a variety of Serpentine, by Dana, in 1868.

SCHORL. (Swedish, *Shorl*, brittle.) The old name for Tourmaline.

SCHROTTERITE. First described by Schrötter, in 1837; named after him, by Glocker, in 1839.

SCORODITE. (Gr. *Scorodon*, garlic.) Described by Bournon, in 1801; named by Breithaupt, in 1817, in allusion to its odour when heated before the blowpipe.

SENARMONTITE. First described by Senarmont, in 1851; named by Dana, in honour of the discoverer, the same year.

SERPENTINE. Mentioned by the ancients as Ophites.

SILVER. (Germ. *Silber*.) Known to the ancients.

SMALTITE. Described by Agricola, in 1529; separated from Cobaltite, by Romé de Lisle, in 1772 and 1783, on crystallographic grounds; named Smaltine, by Beudant, in 1852; Smaltite, by Dana, in 1868.

SMECTITE. Named and defined by Breithaupt, in 1841.

STANNITE. First discovered in Cornwall at Huel Rock; described by Klaproth, in 1787; named Stannine, by Beudant, in 1832, Stannite, by Dana, in 1868.

STAUROLITE. Described and figured by De Robien, in 1751; named by Delameth, in 1792.

STEATITE. (Gr. *Stear*, fat.) Discovered at first in Cornwall; described by Cronstedt, in 1758; named by Kirwan, in 1794; named Saponite, by Vanberg, in 1841, and the name adopted by Dana, in 1868.

STEPHANITE. Described by Agricola, in 1546; named by Haidinger, in 1845, after the Archduke Stephan, Mining Director of Austria.

STIBICONITE. (*Stibium*, antimony, and *konis*, a powder.) Described and named by Beudant, in 1832.

STILBITE. (Gr. *Stilbe*, lustre.) Described as *Zeolite*, by Cronstedt, in 1756; named by Hauy, in 1798.

SULPHUR. Known to the ancients; origin of name unknown.

TALC. Described by Agricola, in 1546, as *Talck* or *Glimmer*.

TITANITE. First described by Pictet, in 1787; named by Klaproth, in 1795.

TOPAZ. (Gr. *Topazios*, an island in the Red Sea.) Described as Topas, by Wallerius, in 1747.

TORBERNITE. First mentioned by Von Born, in 1772; named Torberit, by Werner, in 1793, after the chemist, Torbernus Bergmann.

TOURMALINE. Mentioned by Rinmann, and the name applied to the transparent Tourmalines in 1766; applied to all the varieties, by Hauy, in 1801.

VALENTINITE. Mentioned by Moncey, in 1783; named after Basil Valentine, the discoverer of Antimony, by Haidinger, in 1845.

VIVIANITE. Mentioned by Cronstedt, in 1758; named after J. G. Vivian, the English mineralogist, who first discovered the English specimens, by Werner, in 1817.

WAD. Mentioned by Cronstedt, in 1858; named by Kirwan, in 1796.

WAVELLITE. First discovered by Mr. I. Hill, of Tavistock, in 1785; named Wavellite, by Dr. Babington, in 1805, after Dr. Wavell, of Barnstaple, who first analysed it.

WITTICHENITE. Described by Klaproth, in 1807; named from its first locality, Wittichen, Baden, by Von Kobell, in 1853.

WOLFRAM. Mentioned by Agricola, in 1546; named *Volfram*, by Wallerius, in 1747; named Wolframit, by Breithaupt, in 1832; and Wolframite, by Dana, in 1868.

WOLFRAMITE. First mentioned by Silliman, in 1822; named Wolframine by Greg and Lettsom, in 1858.

ZIPPÆITE. First mentioned by J. F. John, in 1821; named by Haidinger, after the mineralogist, Zippe, in 1845.

TABLE OF THE ELEMENTS,

SO FAR AS THEY ARE AT PRESENT KNOWN.

(Those printed in capitals are the most important; those in small capitals of less importance; the remainder are either of rare occurrence or very little known.)

METALLOIDS.

Name.	Symbol.	Atomic or unit weight.	Physical condition when uncombined.	Remarks.
BORON.	B.	11	Solid.	In Schorl and other minerals.
BROMINE.	Br.	80	Liquid.	In sea water.
CARBON.	C.	12	Solid.	As Graphite, and in Carbonates.
CHLORINE.	Cl.	35·5	Gas.	In several Chlorides.
FLUORINE.	F.	19	—	Chiefly in Fluor Spar.
HYDROGEN.	H.	1	Gas.	In water, and all hydrated minerals.
IODINE.	I.	127	Do.	In sea weed.
NITROGEN.	N.	14	Do.	Largely in the air.
OXYGEN.	O.	16	Do.	In the air, and in all oxides.
PHOSPHORUS.	P.	31	Solid.	In many Phosphates.
Selenium.	Se.	79	Do.	Not known to have occurred in Dev. or Corn.
SILICON.	Si.	28·5	Do.	Abundant in Quartz, and in numerous Silicates.
SULPHUR.	S.	32	Do.	Abundant in Sulphides and Sulphates.

TABLE OF THE ELEMENTS.—*(Cont.)* METALS.

Name.	Symbol.	Atomic or unit weight.	Physical condition when uncombined.	Remarks.
ALUMINIUM.	Al.	27·5	Solid.	Abundant in Felspar and and Kaolin.
ANTIMONY.	Sb.	122	Do.	Occurs in Antimonite and other minerals.
ARSENIC.	As.	75	Do.	Abundant in Mispickel and various Arseniates.
BARIUM.	Ba.	137	Do.	In Barytes.
BISMUTH.	Bi.	208	Do.	Native and in Bismuthinite.
CADMIUM.	Cd.	112	Do.	Occurs rarely in Blende.
Cæsium.	Cs.	133	Do.	Not known in Cornwall or Devon.
CALCIUM.	Ca.	40	Do.	In Calcite and Dolomite.
Cerium.	Ce.	92	Do.	Occurs in Churchite.
CHROMIUM.	Cr.	52·5	Do.	In Chromite.
COBALT.	Co.	58·8	Do.	In Smaltite and a few other minerals.
COPPER.	Cu.	63·5	Do.	Native, and in many mineral compounds.
Didymium.	D.	96	Do.	In Churchite; discovered by the spectroscope.
Glucinum.	G.	14	Do.	Very rare; in Beryl.
GOLD.	Au.	197	Do.	Native, in stream works, also in Pyrites.
Indium.	In.	74	Do.	Not known.
Iridium.	Ir.	198	Do.	Do.
IRON.	Fe.	56	Do.	Common in many minerals
Lanthanium.	L.	92	Do.	Not known.
LEAD.	Pb.	207	Do.	Common in Galena and other minerals.
LITHIUM.	Li.	7	Do.	In mineral waters and in various Micas.
MAGNESIUM.	Mg.	24	Do.	In Serpentine, &c.
MANGANESE.	Mn.	55	Do.	In Pyrolusite and other minerals.
MERCURY.	Hg.	200	Liquid.	Not known.
Molybdenum.	Mo.	92	Solid.	In Molybdenite.
NICKEL.	Ni.	59	Do.	In Niccolite and other minerals.
Niobium.	Nb.	97	Do.	Not known.
Osmium.	Os.	199	Do.	Do.
Palladium.	Pd.	106·5	Do.	Do.
PLATINUM.	Pt.	197	Do.	Do.
POTASSIUM.	K.	39	Do.	In Felspar, &c.
Rhodium.	Rh.	104	Do.	Not known.
Rubidium.	Rb.	85·5	Do.	Do.
Ruthenium.	Ru.	104	Do.	Do.
SILVER.	Ag.	108	Do.	Native, and in various mineral compounds.
SODIUM.	Na.	23	Do.	Common in sea water; also occurs in Albite.
STRONTIUM.	Sr.	87·5	Do.	In Celestite; rare.
Tantalum.	Ta.	137·5	Do.	Not known.
Tellurium.	Te.	128	Do.	Do.
Thallium.	Tl.	204	Do.	Perhaps occurs in some Cornish Pyrites.

TABLE OF THE ELEMENTS.—*(Cont.)* METALS.

Name.	Symbol.	Atomic or unit weight.	Physical condition when uncombined.	Remarks.
Thorium.	Th.	231·5	Solid.	Not known.
TIN.	Sn.	118	Do.	Abundant in Cassiterite, also in Stannite.
TITANIUM.	Ti.	50	Do.	In Manaccanite and a few other minerals.
TUNGSTEN.	W.	184	Do.	In Wolfram.
URANIUM.	U.	120	Do.	In Pitchblende and other minerals.
Vanadium.	V.	51	Do.	Not known.
Yttrium.	Y	68	Do.	Do.
ZINC.	Zn.	65	Do.	Abundant in Blende.
Zirconium.	Zr.	90	Do.	Not known.

CHAPTER IV.

SYSTEMATIC.

Many different methods of mineralogical arrangement have been proposed, but the chief of those now in use are three, viz.:—

"Chemical," in use at the British Museum, &c.
"Economical," in use at Jermyn-street Museum.
"Mixed," as proposed by Weiss, and adopted by Nicol.

Tables of arrangement, in accordance with these systems, are here given, together with a table, in which they are arranged according to crystalline form, as a matter of interest, or for occasional reference.

1.—CHEMICAL.

NATIVE METALS.

Name.	Symbol.	Name.	Symbol.
Gold	Au	Bismuth	Bi
Silver	Ag	Antimony	Sb
Copper	Cu	Arsenic	As

NATIVE METALLOIDS.

Graphite	C	Sulphur	S

ARSENIDES.

Niccolite	NiAs	Leucopyrite	$FeAs_2$
Domeykite	Cu_3As	Smaltite	$CoAs_2$

SULPHIDES.

Argentite	Ag_2S
Chalcocite	Cu_2S
Galena	PbS
Blende	ZnS
Covellite	CuS
Millerite	NiS

SULPHIDES.—*(Cont.)*

Name.	Symbol.
Pyrrhotite ...	FeS or, perhaps, Fe_7S_8
Pentlandite...	$(\frac{2}{3}Fe\frac{1}{3}Ni)S = 2FeS + NiS$.
Erubescite ...	$(\frac{3}{5}Cu\frac{2}{5}Fe)S = 2CuS + FeS$ or $FeCu_2S_3$
Pyrites.....	FeS_2
Marcasite ...	FeS_2
Molybdenite..	MoS_2
Chalcopyrite.	$(CuFe)S_2$
Stannite	$(\frac{1}{4}CuFeZn\frac{1}{4}Sn)S_2$
Mispickel.....	$Fe(SAs)_2$
Cobaltite.....	$Co(SAs)_2$
Bismuthinite	Bi_2S_3
Antimonite...	Sb_2S_3

SULPHANTIMONIDES AND SULPHARSENIDES.

Pyrargyrite...	$3AgS + Sb_2S_3$
Jamesonite ...	$3PbS + 2Sb_2S_3 = Pb_3Sb_4S_9$
Berthierite a.	$3FeS + 2Sb_2S_3 = Fe_3Sb_4S_9$
Do. b.	$3FeS + 3Sb_2S_3 = Fe_3Sb_6S_{12}$
Do. c.	$3FeS + 4Sb_2S_3 = Fe_3Sb_8S_{15}$
Bournonite...	$3(CuPb)S + Sb_2S_3$
Fahlerz	$4(CuAgHg)S + (SbAs)_2S_3$
Stephanite ...	$5AgS + Sb_2S_3$
Tennantite ...	$4(CuFe)S + As_2S_3$
Polybasite ...	$10(AgCu)S + (SbAs)_2S_3$

OXIDES.

Anhydrous.

Cuprite	Cu_2O		
Melaconite	CuO	Plumbic Ochre.	PbO
Hematite	Fe_2O_3	Valentinite ...	Sb_2O_3
Ilmenite	$(TiFe)_2O_3$	Senarmontite...	Sb_2O_3
Bismite	Bi_2O_3	Cervantite	$Sb_2O_3 + Sb_2O_5$
Arsenolite	As_2O_3	Psilomelane ...	Mn_2O_3 essentially
Anatase	TiO_2	Calcedony	SiO_2
Brookite.....	TiO_2	Jasper	SiO_2
Rutile	TiO_2	Cassiterite	SnO_2
Quartz.....	SiO_2	Pyrolusite	MnO_2

Wolframite ... WO_3

Magnetite..... $Fe_3O_4 = FeO + Fe_2O_3$
Pitchblende... $U_3O_4 = UO + U_2O_3$
Chromite ..... $(FeMgAlCr)_2O_4$

Hydrous.

Manganite ... $Mn_2O_3 + H_2O$
Goethite ..... $Fe_2O_3 + H_2O$
Limonite ..... $Fe_2O_3 + 2H_2O$

Stibiconite ... $Sb_2O_5 + H_2O$

Opal ..... SiO_2 + water in variable proportion.

Asbolane ..... Variable and uncertain.
Wad ..... Do.
Zippeite ..... Do.

SILICATES.

(The composition of silicates varies so much that the formulæ are very complex. A few of the most simple only are given.)

Anhydrous.

Name.	Symbol.
Rhodonite	$MnSiO_3$
Titanite	$Ca(SiTi)O_5$
Amphibole :—	
a. Tremolite	$(\frac{1}{4}Ca\frac{3}{4}Mg)SiO_3$
b. Actinolite	$(\frac{1}{4}Ca\frac{1}{4}Fe\frac{2}{4}Mg)SiO_3$
c. Hornblende	$(\frac{1}{8}Ca\frac{1}{4}Fe\frac{1}{8}Al\frac{3}{8}Mg)SiO_3$
Pyroxene	$(\frac{1}{2}Ca\frac{1}{2}Mg)SiO_3$
Hypersthene	$(MgFe)SiO_3$
Babingtonite	$(FeCa)SiO_3 = Si_5O_6Feo''_2Cao''_6Si_3O_3Fe_2o^{vi}$
Beryl	$(AlBe)SiO_3 = Si_6O_6Al_2o^{vi}Beo''_3$
Talc	$2MgSiO_3 + SiO_2$
Albite	$Al_2O_3Na_2O6SiO_2 = Si_6O_6Nao_2Al_2o^{vi}$
Orthoclase	$Al_2O_3K_2O6SiO_2 = Si_6O_6Ko_2Al_2o^{vi}$
Andalusite	$Al_2O_3SiO_2$
Topaz	$Al_2O_3SiO_2$ with one-fifth of the O replaced by F
Chondrodite	Silicate of Magnesia, with some Fluorine.
Garnet	A complex Silicate of many bases.
Axinite	,, Silicoborate of Alumina, Lime & Iron.
Tourmaline	,, ,, Alumina, and many other bases.
Epidote	,, Silicate, Alumina, Lime and Iron.
Scapolite	,, ,, Lime and Alumina.
Muscovite	,, ,, Potash, Magnesia, Alumina, and Iron.
Lepidolite	,, ,, Potash, Lithia, and Alumina.
Lepidomelane	,, ,, Potash, Lithia, Alumina, Iron, &c.
Porcellanite	,, ,, Lime, Alumina, and Soda.
Staurolite	,, ,, Alumina and Iron.
Isopyre	,, ,, Alumina, Iron, and Lime.
Saussurite	Perhaps only impure Silica.

Hydrous.

Steatite	$MgSiO_3 + H_2O$
Chrysocolla	$CuSiO_3 + 2H_2O$
Serpentine	$2MgSiO_3 + MgH_2O_2 + H_2O$
Stilbite	Silicate of Alumina and Lime.
Prehnite	Do. Do.
Natrolite	Silicate of Alumina and Soda.
Analcite	Do. Do.
Mesolite	Silicate of Alumina, Lime, and Soda.
Kaolin	Silicate of Alumina.
Gilbertite	Do.
Allophane	Do.
Schrotterite	Do.
Smectite	Do.
Hisingerite	Silicate of Iron.
Chloropal	Do.
Cronstedtite	Do.
Chlorite	Silicate of Alumina, Magnesia, and Iron.
Agalmatolite	Silicate of Alumina and Potash.
Pinite	Do. Do.
Glauconite	Silicate of Iron and Potash.
Schiller Spar	Silicate of Iron and Magnesia.

TUNGSTATES.

Name.	Symbol.	Name.	Symbol.
Wolfram	$FeWO_4$	Scheelite	$CaWO_4$

CARBONATES.

Anhydrous.

Calcite	$CaCO_3$ or COCa$_{\text{o}}$"	Calamine	$ZnCO_3$
Aragonite	$CaCO_3$	Diallogite.....	$MnCO_3$
Dolomite	$(CaMg)CO_3$	Cerussite	$PbCO_3$
Chalybite	$FeCO_3$	Agnesite	Impure Carbonate of Bismuth.
Magnesite.....	$MgCO_3$		

Hydrous.

Malachite ..... $CuCO_3 + CuH_2O_2$ Chessylite ..... $2CuCO_3 + CuH_2O_2$

SULPHATES.

Anhydrous.

Anglesite ..... $PbSO_4 = SO_2Pbo$" Celestite ..... $SrSO_4$
Barytes ..... $BaSO_4$

Hydrous.

Gypsum	$CaSO_4 + 2H_2O$
Cyanosite	$CuSO_4 + 5H_2O$
Melanterite	$FeSO_4 + 7H_2O$
Goslarite.....	$ZnSO_4 + 7H_2O$
Johannite	$USO_4 + H_2O$ (somewhat uncertain.)
Kalinite	$(\frac{1}{2}Al\frac{1}{2}K)SO_4 + 6H_2O$
Linarite	$PbSO_4 + CuH_2O_2$
Langite	$CuSO_4 + 3CuH_2O_2 + 2H_2O$
Brochantite	$2CuSO_4 + 5CuH_2O_2$

ARSENIATES AND PHOSPHATES.

Anhydrous.

Mimetite	$3(Pb_3As_2O_4) + PbCl_2$
Pyromorphite	$3(Pb_3P_2O_4) + PbCl_2$
Apatite :—	
a. Chloroapatite	$3(Ca_3P_2O_4) + CaCl_2$
b. Fluorapatite.	$3(Ca_3P_2O_4) + CaF_2$

Hydrous.

Olivenite	$Cu_3As_2O_8 + CuH_2O_2$
Clinoclase.....	$Cu_3As_2O_8 + 3CuH_2O_2$
Cornwallite—a. ...	$Cu_3As_2O_8 + 2CuH_2O_2 + H_2O$
,, b. ...	$Cu_3As_2O_8 + 2CuH_2O_2 + 3H_2O$
Erinite	$Cu_3As_2O_8 + 2CuH_2O_2$
Chalcophyllite—a.	$Cu_3As_2O_8 + 5CuH_2O_2 + 7H_2O$
,, b.	$Cu_3As_2O_8 + 5CuH_2O_2 + 9H_2O$
,, c.	$Cu_3As_2O_8 + 5CuH_2O_2 + Al_2H_2O_6 + 16H_2O$
,, d.	$Cu_3As_2O_8 + 5CuH_2O_2 + Al_2H_2O_6 + 17H_2O$
Liroconite.....	$2(Cu_3As_2O_3) + 2CuH_2O_2 + Al_2H_2O_6 + 19H_2O$
Chenevixite	$Cu_3As_2O_8 + Fe_2As_2O_8 + CuH_2O_2 + FeH_2O_2 + 4H_2O$
Bayldonite	$Cu_2PbAs_2O_8 + CuH_2O_2 + 2H_2O$
Annabergite.....	$Ni_3As_2O_8 + 8H_2O$
Erythrite	$Co_3As_2O_8 + 8H_2O$
Pharmacosiderite..	$Fe_2As_2O_8 + 8H_2O$
Scorodite	$Fe_2As_2O_8 + 4H_2O$
Pitticite.....	$Fe_2As_2O_8 + H_2SO_4$

II.—ECONOMICAL.

(Adopted at the Museum of Practical Geology, Jermyn-street, London.)

DIVISION I.—NON-METALLIC MINERALS.

CLASS 1.—CARBON AND BORON.

Group 1.—*Carbon and its Compounds.*
- Graphite.
- Anthracite.

Group 2.—*Hydrocarbons.*
- Bitumen.
- Retinite.

Group 3.—*Inflammable Salts.*

Group 4.—*Boron and its Compounds.*

CLASS 2.—SULPHUR AND SELENIUM.

Group 1.—*Sulphur and its Compounds.*
- Sulphur.

Group 2.—*Selenium and its Compounds.*

CLASS 3.—HALOIDS AND SALTS.

Group 1.—*Ammonia.*

Group 2.—*Potash.*

Group 3.—*Soda.*
- Halite.

Group 4.—*Baryta.*
- Barytes.

Group 5.—*Strontia.*
- Celestite.

Group 6.—*Lime.*
- Calcite.
- Aragonite.
- Dolomite.
- Apatite.
- Gypsum.

Group 6.—*(Cont.)*
- Scheelite.
- Fluor.

Group 7.—*Magnesia.*
- Magnesite

Group 8.—*Alumina.*
- Kalinite.
- Wavellite
- Tavistockite
- Childrenite

Group 8.—*Ceria.*
- Churchite

Group 9.—*Zirconia.*

Group 10.—*Yttria.*

CLASS 4.—EARTHS.

(Silica, Alumina, and Magnesia, with their hydrates.)

Group 1.—*Silica.*
- Quartz
- Jasper
- Calcedony
- Opal

Group 2.—*Alumina.*

Group 3.—*Magnesia.*

CLASS 5.—SILICATES AND ALUMINATES.

The groups here are mostly chemical, the *Felspars*, *Zeolites*, and *Garnets* being made into distinct groups.

DIVISION II.—METALLIC MINERALS.

CLASS 1.—MINERALS CONTAINING METALS THAT ARE BRITTLE AND FUSIBLE ONLY WITH DIFFICULTY.

Group 1.—*Titanium.*
- Anatase
- Rutile
- Brookite
- Ilmenite
- Titanite

Group 2.—*Tantalum.*

Group 3.—*Niobium and Pelopium.*

Group 4.—*Tungsten.*
- Wolframite
- Scheelite
- Wolfram

Group 5.—*Molybdenum.*
- Molybdenite

Group 6.—*Vanadium.*

Group 7.—*Chromium.*
- Chromite

Group 8.—*Uranium.*
- Zippæite
- Pitchblende
- Johannite
- Autunite
- Torbernite

Group 9.—*Manganese.*
- Psilomelane
- Wad
- Pyrolusite
- Manganite
- Braunite
- Diallogite
- Rhodonite

CLASS 2.—MINERALS CONTAINING METALS THAT ARE BRITTLE, EASILY FUSIBLE, AND VOLATILE.

Group 1.—*Arsenic.*
- Arsenic
- Arsenolite
- Leucopyrite
- Condurrite
- Smaltite

Group 2.—*Antimony.*
- Antimony
- Senarmontite
- Valentinite
- Stibiconite

Group 2.—*(Cont.)*
- Cervantite
- Antimonite
- Jamesonite

Group 3.—*Tellurium.*

Group 4.—*Bismuth.*
- Bismuth
- Bismite
- Bismuthinite
- Wittichenite

CLASS 3.—MINERALS CONTAINING METALS THAT ARE MALLEABLE; NOT REDUCIBLE BY HEAT ALONE.

Group 1.—*Zinc.*
- Calamine
- Blende
- Goslarite

Group 2.—*Cadmium.*

Group 3.—*Tin.*
- Cassiterite
- Stannite

Group 4.—*Lead.*
- Plumbic Ochre
- Cerussite
- Galena
- Anglesite
- Cromfordite
- Pyromorphite
- Mimetite
- Bleinierite
- Jamesonite
- Bournonite
- Linarite

Group 5.—*Iron.*
- Magnetite
- Hematite
- Goethite
- Limonite
- Chalybite
- Vivianite
- Pyrrhotite
- Pyrites
- Marcasite
- Mispickel
- Leucopyrite
- Melanterite
- Cronstedtite
- Chloropal
- Pharmacosiderite
- Scorodite
- Pitticite

Group 6.—*Cobalt.*
- Asbolane
- Cobaltite
- Smaltite
- Erythrite

Group 7.—*Nickel.*
- Annabergite
- Millerite
- Niccolite
- Pentlandite

Group 8.—*Copper.*
- Copper
- Cuprite
- Melaconite
- Malachite
- Chessylite
- Lunnite
- Libethenite
- Chalcocite
- Covellite
- Erubescite
- Chalcopyrite
- Fahlerz
- Tennantite
- Bournonite
- Brochantite
- Cyanosite
- Atacamite
- Chrysocolla
- Torbernite
- Condurrite
- Cornwallite
- Clinoclase
- Olivenite
- Liroconite
- Chalcophyllite

CLASS 4.—MINERALS CONTAINING NOBLE METALS; REDUCIBLE BY HEAT ALONE.

Group 1.—*Mercury.*

Group 2.—*Silver.*
- Silver
- Kerate
- Argentite
- Stephanite
- Polybasite
- Pyrargyrite

Group 3.—*Gold.*—Gold

Group 4.—*Platinum.*

Group 5.—*Palladium.*

Group 6.—*Rhodium.*

Group 7.—*Iridium.*

Group 8.—*Osmium.*

Group 9.—*Lanthanium.*

Group 10.—*Columbium.*

III.—MIXED.
(System of Weiss and Nicol.)

ORDER I.—OXIDISED STONES.

Fam. 1.—*Quartz.*
- Quartz
- Jasper
- Calcedony
- Opal

Fam. 2.—*Felspar.*
- Orthoclase
- Albite

Fam. 3.—*Scapolite.*
- Prehnite

Fam. 4.—*Haloid Stones.*
- Wavellite

Fam. 5.—*Zeolite.*
- Natrolite
- Stilbite
- Analcite

Fam. 6.—*Mica.*
- Muscovite
- Lepidolite
- Lepidomelane
- Chlorite
- Talc
- Schiller-spar
- Serpentine
- Cronstedtite

Fam. 7.—*Hornblende.*
- Amphibole

Fam. 7.—*(Cont.)*
- Pyroxene
- Hypersthene
- Rhodonite
- Babingtonite
- Isopyre

Fam. 8.—*Clay.*
- Kaolin
- Smectite
- Allophane
- Schrotterite
- Agalmatolite
- Steatite

Fam. 9.—*Garnet.*
- Garnet
- Epidote
- Axinite
- Andalusite
- Staurolite

Fam. 10.—*Gems.*
- Topaz
- Beryl
- Tourmaline
- Chondrodite

Fam. 11.—*Metallic Stones.*
- Chloropal

ORDER 2.—SALINE STONES.

Fam. 1.—*Calc Spar.*
- Calcite
- Aragonite
- Dolomite
- Magnesite

Fam. 2.—*Fluor Spar.*
- Fluor
- Fluellite
- Apatite
- Childrenite

Fam. 3.—*Heavy Spar.*
- Barytes

Fam. 3.—*(Cont.)*
- Celestite

Fam. 4.—*Gypsum.*
- Gypsum

Fam. 5.—*Rock Salt.*
- Halite
- Kalinite
- Mc!anterite
- Goslarite
- Cyanosite
- Johannite

ORDER 3.—SALINE ORES.

Fam. 1.—*Sparry Iron Ores.*
- Chalybite
- Diallogite
- Calamine
- Pittioite

Fam. 2.—*Copper Salts.*
- Chrysocolla
- Chessylite
- Malachite
- Chalcophyllite
- Erinite
- Liroconite
- Olivenite
- Clinoclase
- Lunnite
- Libethenite
- Atacamite
- Pharmacosiderite
- Scorodite

Fam. 2.—*(Cont.)*
- Brochantite
- Langite
- Vivianite
- Torbernite
- Autunite
- Erythrite
- Annabergite

Fam. 3.—*Lead Salts.*
- Cerussite
- Anglesite
- Linarite
- Cromfordite
- Pyromorphite
- Mimetite
- Bleinierite
- Kerate
- Scheelite

ORDER 4.—OXIDISED ORES.

Fam. 1.—*Oxidised Iron Ores.*
- Magnetite
- Chromite
- Ilmenite
- Hematite
- Limonite
- Goethite

Fam. 2.—*Tin Ore.*
- Cassiterite
- Wolfram
- Titanite
- Brookite
- Anatase
- Rutile
- Pitchblende

Fam. 3.—*Manganese Ores.*
- Pyrolusite
- Manganite
- Braunite
- Psilomelane

- Wad
- Asbolane
- Bismite
- Wolframite
- Zippeite
- Plumbic Ochre

Fam. 4.—*Red Copper Ores.*
- Cuprite

Fam. 5.—*White Antimony Ores.*
- Valentinite
- Senarmontite
- Arsenolite

ORDER 5.—NATIVE METALS.

Fam. 1.
- Gold
- Silver
- Copper

Fam. 1.—*(Cont.)*
- Bismuth
- Antimony
- Arsenic

ORDER 6.—SULPHURETTED METALS.

Fam. 1.—*Pyrites.*
- Pyrites
- Marcasite
- Pyrrhotite
- Leucopyrite
- Mispickel
- Cobaltite
- Smaltite
- Niccolite
- Millerite
- Pentlandite
- Chalcopyrite
- Erubescite
- Condurrite

Fam. 2.—*Lead Glance.*
- Galena
- Argentite
- Chalcocite
- Covellite
- Molybdenite

Fam. 3.—*Grey Antimony Ore.*
- Antimonite
- Jamesonite
- Berthierite
- Bismuthinite

Fam. 4.—*Grey Copper Ore.*
- Fahlerz
- Tennantite
- Bournonite
- Stephanite
- Polybasite
- Stannite
- Wittichenite

Fam. 5.—*Blende.*
- Blende

Fam. 6.—*Ruby Blende.*
- Pyrargyrite

ORDER 7.—INFLAMMABLE.

Fam. 1.—*Sulphur.*
- Sulphur

Fam. 2.—*Diamond.*

Fam. 3.—*Coals.*
- Graphite
- Anthracite

Fam. 3.—*(Cont.)*
- Lignite

Fam. 4.—*Mineral Resins.*
- Bitumen
- Retinite

IV.—ARRANGEMENT ACCORDING TO CRYSTALLINE FORM.

1.—CUBIC.

- Analcite
- Argentite
- Arsenolite
- Bismite (?)
- Blende
- Chromite
- Cobaltite
- Copper
- Cuprite
- Erubescite
- Fahlerz
- Fluor
- Galena
- Garnet
- Gold
- Halite
- Kalinite
- Kerate
- Magnetite
- Pentlandite
- Pharmacosiderite
- Pyrites
- Senarmontite
- Silver
- Smaltite
- Stannite (?)
- Tennantite
- Wolframite (?)

2.—PYRAMIDAL.

Anatase	Chalcopyrite	Scapolite	Rutile
Braunite	Cromfordite	Scheelite	Torbernite
Cassiterite			

3.—RHOMBIC.

Andalusite	Cerussite	Lepidomelane	Pyrolusite
Anglesite	Cervantite	Libethenite	Scorodite
Antimonite	Chalcocite	Liroconite (?)	Stephanite
Aragonite	Childrenite	Lunnite (?)	Staurolite
Atacamite	Chondrodite	Manganite	Stilbite
Autunite	Erinite (?)	Marcasite	Sulphur
Barytes	Fluellite	Mispickel	Tavistockite (?)
Berthierite	Gilbertite	Natrolite	Topaz
Bismuthinite	Goethite	Olivenite	Valentinite
Bournonite	Goslarite	Pinite	Wavellite
Brochantite	Jamesonite	Polybasite (?)	Wittichenite
Brookite	Langite	Porcellanite (?)	Wolfram
Celestite	Lepidolite	Prehnite	

4.—OBLIQUE.

Amphibole	Clinoclase	Johannite	Pyroxene
Annabergite	Epidote	Linarite	Rhodonite
Beraunite	Erythrite	Malachite	Schiller Spar
Chessylite	Gypsum	Melanterite	Titanite
Churchite	Hypersthene	Orthoclase	Vivianite

5.—ANORTHIC.

Albite	Babingtonite	Mesolite?	Saussurite?
Axinite	Cyanosite		

6.—HEXAGONAL.

Antimony	Chalybite	Hematite	Niccolite
Apatite	Chlorite	Ilmenite	Pyrargyrite
Arsenic	Connellite	Magnesite	Pyromorphite
Beryl	Covellite	Millerite	Pyrrhotite
Bismuth	Cronstedtite	Mimetite	Quartz
Calamine	Diallogite	Molybdenite	Talc
Calcite	Dolomite	Muscovite (?)	Tourmaline
Chalcophyllite	Graphite		

7.—AMORPHOUS.

Agalmatolite	Chloropal	Kaolin	Retinite
Agnesite	Chrysocolla	Limonite	Schrotterite
Allophane	Cornwallite	Melaconite	Serpentine
Asbolane	Demidoffite	Opal	Smectite
Bayldonite	Domeykite	Pigotite	Steatite
Bitumen	Glauconite	Pitchblende	Stibiconite
Bleinierite	Hisingerite	Pitticite	Wad
Calcedony	Isopyre	Plumbic Ochre	Zippæite
Chenevixite	Jasper	Psilomelane	

CHAPTER V.

DISTRIBUTIVE.

Of the large number of minerals which have been found in the district treated of in this Handbook, some, as the various forms of Quartz, occur almost everywhere; others, such as Pyrites, are found wherever mining is carried on; others, again, occur only in small quantities or are limited to certain areas. Thus, ores of Iron, chiefly Hematite or Limonite, are to be found in the parish and neighbourhood of St. Just, in the parishes of Constantine, Ladock,

and Perranzabuloe, at Huel Ruby, Retire, and Restormel; at Ilsington, Brixham, and other places, while small quantities of the same, and closely related minerals, are to be met with in most mines.

Manganese ores are by no means so widely distributed, for they are almost entirely unknown in the West of Cornwall, although found in abundance near Launceston, near Tavistock, Brent Tor, at Upton Pyne, and many other places in Devonshire.

Among the rarer "metallic minerals" several of the arseniates of copper have only been noticed in Gwennap. Ilmenite or Titaniferous Iron Ore is only to be found in or near St. Keverne; Anatase and Brookite occur in very small quantities only at Virtuous Lady Mine, near Tavistock, Delabole, Tintagel, and in a quarry near St. Austell. The distinguishing material of these minerals, however, Titanic Acid, is very widely distributed through our Cornish rocks, as shewn by Mr. J. A. Phillips's recent analyses, so that additional localities for them may perhaps occur ere long. Chromite has been found in small quantity, but only in the Lizard district. Among the "non-metallic" minerals, Garnet only occurs near a junction of granite and greenstone, the localities being tolerably numerous, although the mineral is never abundant. Topaz occurs only in granite, but in localities as widely separated as St. Michael's Mount and Lundy Island. Beryl has been found in some of the same localities, but is still more rare. Barytes has occurred only at one locality west of Truro, viz., at the Gwennap Mines, with copper ores. It has also occurred in tolerable quantity at Herodsfoot, at Huel Mary Ann, with lead ores, and at Babbicombe Bay, and other localities in Devon, with Calcite.

The Zeolites are found only at St. Just, in a narrow strip of greenstone, which forms the precipitous coast, and at Stenna Gwynn, and very sparingly even in these localities. Wavellite has only been certainly found near Barnstaple, although found there 87 years ago.

Graphite has occurred in small nodules in elvan courses at Kerjiliack, near Penryn; at Tuckingmill; near Grampound; and at Boscastle. Retinite has occurred only in the Lignites of Bovey Tracey; Mineral Pitch only in the copper mines in Gwennap, Illogan, and neighbouring parishes, and perhaps at Chudleigh, in Devon.

A list of mines and mineralogical localities in the two counties, with the minerals which have been noticed, is given below. The more common minerals are only mentioned when particularly fine, or remarkable for their situation. Of the rarer minerals every locality known to the author has been set down. Mines at work in January, 1871, are indicated by small capitals, and the material chiefly raised is indicated in a separate column. When a mineral is very characteristic of a given locality, or occurs in a very fine condition, its name is printed in small capitals.

LIST OF MINES AND MINERALOGICAL LOCALITIES, TOPOGRAPHICALLY ARRANGED.

CORNWALL.—HUNDRED OF PENWITH.
(West Division.)

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Scilly.		—	Flints on the beaches and high lands (DelaBeche, Rep. Dev. Corn.) Schorl occasionally in the granite, sometimes replacing Mica (Statham, Geologist, vol. II., p. 23.
Sennen.	Land's End.	—	Schorl, fractured flints in elevated positions.
Do.	Nangisel Cove.	—	Amethyst, Pinite; occasionally fine crystals of Orthoclase in the Granite.
St. Levan.	Tol Pedn Penwith.	—	Pinite.

LIST OF MINES, &c.—CORNWALL, PENWITH, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals
St. Burian.	Boscawen Cliffs.	—	Axinite, Rock Crystal.
Do.	Penberth.	—	WOOD-TIN.
Do.	Lamorna Cove.	—	Axinite, Epidote, Pinite, Topaz.
Do.	Rose-moddress.	—	Garnet.
Do.	Carn Silver.	—	Epidote.
St. Just.	BALLESWIDDEN	Tin.	Bismuthinite, Bismuth, Lithomarge; fine crystals of Orthoclase, and Mica in the Granite.
Do.	Bellon, Huel.		Amethyst, Mica.
Do.	BOSCASWELL or BOSCASWELL DOWNS.	Tin and Copper.	Calcedony, Cassiterite.
Do.	BOSCEAN. Boscreagen.	Tin.	Fine imbedded crystals of reddish-brown and white Orthoclase.
Do.	BOSORN.	Tin.	Occasionally fine crystals of Cassiterite.
Do.	Boshase Moor.		Stream Tin.
Do.	BOSWEDDAN and HUEL CASTLE.	Tin.	Beryl (Huel Castle).
Do.	BOTALLACK and CARNYORTH, with HUEL COCK and the Cliffs to the north.	Tin and Copper.	Actinolite, Amethyst, Apatite, Aragonite, Atacamite, Augite, Axinite, Bismuth, Bismuthinite BOTALLACKITE, Calcite, Chalcocite, Cobaltite, Cyanosite, Diallogite, Dolomite, Epidote, Erythrite, Fahlerz? Fluor, Garnet, Goethite, Goslarite, Jasper, Kerate, Magnetite, Malachite, Manganite, Mesolite, Mispickel, Natrolite, Opal, Pitchblende, Pharmacosiderite, Prehnite, Pyrrhotite, Silver, Smaltite, Steatite, Stannite, Stilbite, Tallingite, Tourmaline, Tremolite, Vivianite, &c.
Do.	Cape Cornwall.	—	Schorl, Hornblende, Actinolite.
Do.	CAPE CORNWALL MINE.	Tin.	Dolomite, Garnet, Jasper.
Do.	Carne, Huel.		Axinite, ISOPYRE, Prehnite, Natrolite, Stilbite.
Do.	Carn Bosavern.	—	LEPIDOMELANE.
Do.	Chycornish Carn.	—	Garnet.
Do.	Crowns Rock.	—	GARNET, MAGNETITE, Actinolite, APATITE, AXINITE, Epidote, Natrolite, Prehnite, &c.
Do.	Cunning, Huel.		Mica, Cassiterite.
Do.	Diamond, Huel.		ROCK CRYSTAL.
Do.	LEVANT.	Tin and Copper.	Amethyst, Aragonite, Bismuth, Bismite, Chalcocite, Dolomite, Fahlerz? Hornblende, Kerate, Pharmacosiderite, SILVER.
Do.	LEVANT, NORTH.	Tin.	Cassiterite.
Do.	Little Bounds.		Chlorite, Schorl.

LIST OF MINES, &c.—CORNWALL, PENWITH, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Just (*Cont.*)	OWLES, HUEL & Huel Edward.	Tin.	Actinolite, Apatite, Calcite, Chalybite, Diallogite, Pharmacosiderite (Huel Owles); Aragonite, Autunite, Chrysocolla, Malachite, Pitchblende, Torbernite, VIVIANITE, Zippæite (Huel Edward).
Do.	Pendeen Consols	Tin and Copper.	Cassiterite.
Do.	Pendeen Cove (south of).	—	Steatite, in small veins in slate.
Do.	Parknoweth.	—	Cassiterite, Chlorite, Schorl, Vivianite.
Do.	Roscommon Cliff	—	Asbolane, Axinite, Erythrite, Selenite, Tourmaline.
Do.	SPEARNE CONSOLS.	Tin.	
Do.	SPEARN MOOR.	Tin and Copper.	Fluor, Rock Crystal.
Do.	Stennack, Huel.		Jasper.
Do.	St. JUST AMALGAMATED.	Tin.	Cassiterite.
Do.	Tregarva Moor.	—	Cassiterite, Gold (in ancient stream works).
Do.	Trewellard Cliff.	—	Axinite, Pinite, Rock Crystal.
Sancreed.	Mulvra Hill.	—	Pinite; fine crystals of Orthoclase
Paul.	Wherry Mine.	Tin.	Cassiterite, Cobaltite.
Morvah.	Garden Mine.	Tin.	
Do.	Morvah United.		Chlorite, Felspar, Fluor, Hematite, Mica, Schorl.
Madron.			Chalybite, Sphærosiderite.
Gulval.	DING DONG.	Tin.	Chlorite, Fluor, Jasper, Chalcocite, Schorl.
Ludgvan.	Vorlas.	—	Flint.
Do.	Darlington, Huel		Mispickel, Pyrites, Schorl, Cassiterite.
Do.	Darlington, West Huel.		Argentite, Galena (argentiferous), NATIVE SILVER.
Zennor.	CARNELLOW.	Copper and Tin.	Occasional fine crystals of Cassiterite.
Towednack.	GIEW CONSOLS.	Tin.	Cassiterite, Schorl.
Do.	Union, Huel.		Cassiterite, Chlorite, Mica, Schorl.

CORNWALL, PENWITH, *East Division.*

Parish.	Localities.	Produce of Mines.	More remarkable Minerals.
Lelant.	Consolidated Ms.		Cassiterite, Felspar, Mica, Schorl.
Do.	KITTY, HUEL.	Tin.	Cassiterite, Mica.
Do.	MARGARET, HUEL	Tin.	Cassiterite.
Do.	MARGARET, WEST HUEL.	Tin.	Cassiterite.

LIST OF MINES, &c.—CORNWALL, PENWITH, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Lelant *(Cont.)*	MARY, HUEL.	Tin.	Blende, Calamine, Chlorite, Mispickel, Molybdenite.
Do.	Poldice, West.		Actinolite, Cassiterite, Hornblende.
Do.	PROVIDENCE, EAST.	Tin.	
Do.	PROVIDENCE MINES.	Tin and Copper.	Calcedony, Cassiterite, CHALCOCITE, Chalcotrichite, Chlorite, Clinoclase, Copper, Connellite, Liroconite, Mispickel, Pitchblende, Pyrites, SCHORL, Torbernite.
Do.	Ditto (Including Huel Speed.)		Cassiterite, Chalcocite, Chessylite, Cuprite, Felspar, Malachite, Melaconite, Pyrites, Schorl. *(Huel Speed.)*
Do.	PROVIDENCE, SOUTH	Tin.	
Do.	Reeth, Huel.		Cassiterite, Chalcocite, Chlorite, Felspar, Mica, Schorl.
Do.	TREVARRACK UTD	Tin.	Cassiterite, Schorl.
St. Ives.	Balnoon.		Cassiterite, Felspar, Mica, Schorl.
Do.	FANNY ADELA (*Hawke's Point*).	Tin.	Cassiterite.
Do.	Mellanoweth.		Anglesite.
Do.	PENCROM, HUEL.	Tin.	Cassiterite.
Do.	ROSEWALL HILL and RANSOM UNITED.	Tin.	Cassiterite.
Do.	ST. IVES CONSOLIDATED.	Tin and Copper.	Actinolite, BISMUTH, Cassiterite, CHALCOCITE (very fine, recently), Chalcopyrite, Chalcotrichite, Chlorite, Cyanosite, Felspar, Fluor, Hematite, Isopyre? Limonite, Mica, Schorl.
Do.	ST. IVES, WEST.	Tin.	Cassiterite.
Do.	TRELYON CONSLS. (*Huel Venture.*)	Tin and Copper.	Cassiterite.
Do.	Trenwith, Huel.		Chalcocite, Cuprite, Erythrite, Hematite, Hornblende, Melaconite, Pitchblende, Torbernite.
Do.	St. Michael's Mt.	—	Apatite, Beryl, Cassiterite, Fluor, Garnet, Orthoclase, Lepidolite, Pinite, Rock Crystal, Stannite, TOPAZ, Tourmaline, Wolfram, Zippeite.
St. Hilary.	GREAT WESTERN MINES.	Tin and Copper.	Cassiterite.
Do.	Prosper, Huel		MELANTERITE.
Do.	Marazion Mines.		Blende, Chalcopyrite, Felspar, Hornblende, Limonite, Melaconite, Pyrites, Tourmaline.
Do.	Cuddan Point.	—	ACTINOLITE.
Perranuthnoe.	The Grebe.	—	Actinolite.
Do.	Mount Mine?		Argentite.
St. Erth.	Bell, Huel.		Anglesite, Pyromorphite.

LIST OF MINES, &c.—CORNWALL, PENWITH, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Erth(*Cont.*)	Elizabeth, Huel.		Blende, Chalcopyrite, Chlorite, Galena, Melaconite, Pyrites.
Do.	Gilbert, Huel.		Cassiterite.
Do.	Godolphin, West.		Actinolite, Blende, Chalcocite, Galena, Malachite, Melaconite.
Do.	TREVEN.	Tin.	
Do.	MELLANEAR.	Copper.	Chalcopyrite.
Phillack.	Alfred, Huel.		Bayldonite? Calcite, Cerussite, Calcedony, Chalcocite, Chalcopyrite, Erubescite, Kerate, Malachite, Mimetite, PYROMORPHITE (the finest ever found in Cornwall), Rock Crystal, Silver.
Do.	Ann, Huel?		Argentite, Kerate.
Do.	Kayle, Huel.		Chlorite, Chalcopyrite, Galena, Melaconite.
Do.	Boiling Well.		Galena.
Gwithian.	Silver Valley.		Kerate, Silver.
Gwinear.	Carsize Consols.		Blende, Cassiterite, Chalcopyrite, Mispickel.
Do.	Duffield Mine.		Chalcocite, Chalcopyrite, Limonite, Melaconite, Pyrites.
Do.	Gwinear, Huel.		Cassiterite, Molybdenite.
Do.	Herland, Huel.		ARGENTITE, Bismite, Bismuth, Bismuthinite, Cassiterite, Chalcopyrite, KERATE, Limonite, Melaconite, Mispickel, Pyrargyrite, Rock Crystal, Silver, Smaltite, Wolfram.
Do.	Providence, Huel.		Cassiterite, Chalcocite, Chalcopyrite, Melaconite.
Do.	Prince Geo. Mine.		Chrysocolla, Malachite.
Do.	Relistian.		Cassiterite, Chalcocite, Chalcopyrite, Melaconite, Pyrites.
Do.	Relistian, East.		Chlorite, Tennantite.
Do.	Rosewarne.	Tin & Cop.	Cassiterite, Chalcopyrite, Opal.
Do.	ROSEWARNE, CNLS	Tin & Cop.	Cassiterite.
Do.	ROSEWARNE, EST.	Tin & Cop.	Cassiterite.
Do.	Rosewarne, New.		Cassiterite, Chlorite, Dolomite, Jasper, Semi-Opal.
Do.	ROSEWARNE UTD.	Copper.	Chalcopyrite.
Do.	Tremayne, Huel.		Cassiterite, Silver.
Do.	Trevascus, Huel.		Actinolite, Axinite, Bitumen, Blende, Calcedony, Chalybite, Dolomite, Fahlerz, Fluor, Galena, Mispickel, Tennantite.
Do.	Unity, Huel.	Copper and Tin.	Actinolite, Amethyst, Asbolane, Bitumen, Blende, Cassiterite, Chalcopyrite, Chalcophyllite, Chessylite, Chlorite, Chrysocolla, Clinoclase, Connellite, Copper, Cuprite, Erythrite, Fluor, Galena, Jasper, Liroconite, Malachite, Marcasite, Mimetite, Mispickel, Molybdenite, Olivenite, Petroleum, Pharmacosiderite, Pyrites, Scorodite, Tennantite, Torbernite.

LIST OF MINES, &c.—CORNWALL, PENWITH, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Crowan.	CRENVER and HUEL ABRAHAM	Tin and Copper.	Cassiterite, Chalcocite, Chalcopyrite.
Do.	MILLET, HUEL.	Copper.	Chalcopyrite.
Do.	Strawberry, Huel		Blende, Chalcopyrite, Melaconite, Pyrites.
Camborne.	CAMBORNE VEAN	Tin and Copper.	Axinite, Chalcocite, Erubescite, Fluor, Hornblende.
Do.	CARN CAMBORNE.		Mispickel.
Do.	CONDURROW, SOUTH.	Tin and Copper.	Cassiterite.
Do.	Crofty, Huel.		Blende, Galena, Hornblende.
Do.	DOLCOATH.	Tin and Copper.	Amethyst, Argentite, Arsenic? BISMUTH, Bismuthinite, Blende, CASSITERITE, Chalybite, Chalcocite, Chalcopyrite, Chlorite, Copper, Cobaltite, Cuprite, Dolomite, Erubescite, Erythrite, Fluor, Galena, Hematite, Hornblende, Kerate, Langite, Limonite, LITHOMARGE, Malachite, Melaconite, Mispickel, Orthoclase, Pitticite, Pitchblende, Pyrargyrite, Pyrites, ROCK CRYSTAL, Schorl, Silver, Smaltite, Tennantite, Wolfram.
Do.	Dolcoath, North.		Kerate, Silver.
Do.	GRENVILLE, EAST	Copper.	Chalcopyrite.
Do.	GRENVILLE, HUEL	Copper.	Chalcopyrite.
Do.	PENDARVES UTD.	Tin.	Condurrite, Copper, Cassiterite, Fahlerz.
Do.	ROSKEAR, NETH.	Tin and Copper.	Actinolite, Blende, Chalcopyrite, Chlorite, Dolomite, Galena, Haytorite, Jasper, Opal, Prase, Rock Crystal.
Do.	SETON, HUEL.	Copper.	Chalcopyrite.
Do.	STRAY PARK.	Copper and Tin.	Cassiterite.
Illogan.	AGAR, HUEL.	Copper.	Chalcopyrite.
Do.	BASSET, HUEL.	Copper.	Argentite, Autunite, Chalcocite, Chalcopyrite, Copper, Cuprite, Galena, Malachite, Silver.
Do.	BASSET, WEST.	Copper and Tin.	Chalcopyrite, Cuprite.
Do.	Basset, South.		Argentite, Autunite, Chessylite, Chalcocite, Copper, Fahlerz, Malachite, Rock Crystal, Johannite?
Do.	CARN BREA.	Copper and Tin.	Agate, Cassiterite, Chalybite, Chalcocite, Chlorite, Condurrite, Copper, Covellite, Cuprite, Erubescite, Fluor, Goethite, Hematite, Limonite, Mica, Marcasite, Mispickel, Pharmacosiderite, Pyrites, Rock Crystal, Stannite, Tennantite, Wolfram, Smectite?

LIST OF MINES, &c.—CORNWALL, PENWITH, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Illogan (*Cont.*)	CARN BREA, STH.	Tin and Copper.	Chalcopyrite, Cassiterite.
Do.	COOK'S KITCHEN.	Tin and Copper.	Bitumen, Chalcocite, Chlorite, Erubescite, Fahlerz, LITHOMARGE, LONCHIDITE, Marcasite, Mispickel, Pyrites, Schorl, Steatite? Tennantite.
Do.	CROFTY, NORTH HUEL.	Copper and Tin.	Chalcopyrite.
Do.	Crofty, East Huel		Actinolite, Axinite, Bitumen, Blende, Rock Crystal.
Do.	CROFTY, SOUTH HUEL.	Tin and Copper.	Chalybite, Stannite.
Do.	DOLCOATH (STH.) & CARNARTHEN CONSOLS.	Copper.	Chalcopyrite.
Do.	Druid, Huel.		Chondrodite? Condurrite, Goethite, Lithomarge, Limonite.
Do.	EMILY HENRIETTA, HUEL.	Copper.	Chalcopyrite.
Do.	FRANCES, SOUTH HUEL.	Copper.	Chalcopyrite, Chalcotrichite, Cuprite, Cyanosite, Libethenite, Lithomarge.
Do.	FRANCES, WEST HUEL.	Copper.	Chalcopyrite, Cuprite.
Do.	Garth Mine.		Cassiterite, WOOD TIN.
Do.	POOL, EAST.	Copper, Tin, & Wolfram.	Amethyst, Blende, CALCEDONY, CHALCOPYRITE, Chalcocite, Chalybite, CHLOROPHANE, Copper, Cuprite, Erythrite, Felspar, Galena, Leucopyrite, Langite, Malachite, Silver? Smaltite, ROCK CRYSTAL, WOLFRAM.
Do.	Pool, North.	Copper.	Calcedony, Chalcopyrite.
Do.	SETON, EAST HUEL.	Copper.	Chalcopyrite, Pyrites.
Do.	TINCROFT.	Tin and Copper.	Cassiterite, Chalcocite, Chalcopyrite, Chalybite, Chlorite, Cuprite, Erubescite, Goethite, Hematite, Limonite, Lithomarge, Melaconite, Mispickel, Olivenite, Pitchblende, Pyrites, Tennantite, Torbernite.
Redruth.	BASSET, EAST HUEL.	Copper.	Chalcopyrite.
Do.	Beauchamp, Huel		Chalybite, Goethite, Chalcocite.
Do.	BULLER, HUEL.	Copper and Tin.	Amethyst, Calcite, Cassiterite, Chalcocite, Chalcopyrite, Chalybite, Chessylite, Copper, CUPRITE, Fluor, Malachite, Melaconite, Olivenite, Opal, Pitchblende, Rock Crystal, Torbernite, Zippæite.
Do.	Cardrew Downs.	—	Chlorite, Fluor, Limonite, Melaconite.
Do.	CARN BREA, EAST	Copper.	Chalcopyrite.

LIST OF MINES, &c.—CORNWALL, PENWITH, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Redruth (*Cont*)	Clyjah Mine.		Epidote, Garnet, Zippæite.
Do.	COPPER HILL.	Copper.	Chalcocite, Chalcopyrite, LANGITE
Do.	Cupid, Huel.		Fluor.
Do.	Downs, Great North.	Copper.	Chalcopyrite.
Do.	Downs, North.	Copper.	Blende, Cassiterite, Chalcopyrite, Fluor, Limonite, Mimetite? Pyrites.
Do.	Elizabeth, Huel.		Smaltite.
Do.	Fanny, Huel.		Chalcocite, Wolfram.
Do.	HARMONY AND MONTAGUE.		Magnetite, Wolfram.
Do.	PEDN-AN-DREA.	Tin and Copper.	AMETHYST, CALCEDONY, Cassiterite, Chlorophane, Chlorite, Clinoclase, Fluor, Galena, Olivenite, PHARMACOSIDERITE, Psilomelane? Pitchblende, Scorodite, Smaltite, Wad? Wolfram, Zippæite.
Do.	Scorrier Consols.		Rock Crystal, Stannite.
Do.	SPARNON, HUEL.	Tin and Copper.	Agate, Arsenolite, Bismuth, Bismuthinite, Cobaltite, Erythrite, Fluor, Gold, Millerite, Rock Crystal, SMALTITE.
Do.	TOLGUS, WEST.	Copper.	Chalcopyrite.
Do.	TOLGUS, GREAT SOUTH.	Copper.	Chalybite, Erubescite, Mispickel, Wad.
Do.	TOWAN, SOUTH.	Copper.	BITUMEN, Chalcopyrite.
Do.	Trefusis, Huel.		Chessylite, Chrysocolla, Malachite, Melaconite.
Do.	Treleigh, Consls.	Copper.	Chalcopyrite.
Do.	TRELEIGH, NEW.	Copper.	
Do.	Treskerby, Nrth.	Copper and Tin.	Bitumen, Chalcopyrite, Copper, Cuprite, Petroleum?
Do.	UNY, HUEL.	Tin and Copper.	Blende, Cassiterite.

CORNWALL, KIRRIER, *West Division.*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Landewednack.	Kynance Cove.	—	Agate, Asbestos, Calcite, Diallage, Hornblende, Orthoclase, Saussurite? Serpentine, STEATITE, Talc.
Do.	Lizard Head.	—	Calcite, Hornblende, Orthoclase, Talc, Magnetite.
Ruan Major.	Everywhere.	—	SERPENTINE.
Ruan Minor.	Cadgwith.	—	Actinolite, Asbestos, Calcite, Chromite, DIALLAGE, Hornblende, SERPENTINE, PYRITES.
Do.	Caerleon Cove.	—	Orthoclase, in granite veins.
Do.	Kildown.	—	Schiller Spar.
Do.	Kennack Cove.	—	Schiller Spar.

LIST OF MINES, &c.—CORNWALL, KERRIER, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Grade.	Goonhilly Downs	—	Asbestos, Calcedony, Hornblende Serpentine.
Do.	The Balk.	—	Orthoclase and Mica in granite veins.
Mullion.	Gue Graze.	—	STEATITE.
Do.	Ghost Croft.	—	Copper.
Do.	Mullion Island.	—	SERPENTINE.
Do.	Polurian Cove.	—	Chrysocolla, Copper, Cuprite, Hornblende, Malachite, Pyrites, Serpentine, Steatite.
Do.	Pradanack.	—	Hornblende.
Do.	Unity, Huel.		Chrysocolla, Copper, Cuprite.
Do.	Vellan Head.	—	Orthoclase, &c., in granite veins.
St. Keverne.	Black Head.	—	Diallage, Serpentine, Steatite.
Do.	Coverack Cove.	—	DIALLAGE, Hornblende. Orthoclase, SERPENTINE, Steatite.
Do.	Crousa Downs.	—	Diallage, in Diallage rock.
Do.	Downas, Huel.		Chalcocite, Copper.
Do.	Gwendra.	—	Menaccanite, disseminated.
Do.	Gwinter.	—	Magnetite, disseminated in Diallage rock; Saussurite?
Do.	Karak-clews.	—	DIALLAGE.
Do.	Lanarth.	—	Manaccanite.
Do.	Manacle Point.	—	Serpentine, Steatite.
Do.	Pednboar Point.	—	Hornblende.
Do.	Polkerris Point.	—	Hornblende, Serpentine.
Do.	Porthalla.	—	Hornblende, ILMENITE, Limonite.
Do.	Treglossack.	—	Calcite.
Manaccan.	In the bed of a stream.	—	MANACCANITE.
Mawgan.	Trelowarren.	—	Serpentine, Steatite.
Do.	Anson, Huel.	Copper.	Chalcopyrite, Pyrites.
Breage.	FORTUNE, GREAT HUEL.	Tin and Copper.	Cassiterite, Chalcocite, Chalcopyrite, Erubescite, Melaconite, Mica, Orthoclase, Pyrites, Wolfram.
Do.	FORTUNE, SOUTH, HUEL.	Copper.	Chalcopyrite, Cassiterite.
Do.	Godolphin Bridge	Copper.	
Do.	GREAT WORK, WEST.	Tin and Copper.	Cassiterite, Chlorite, Dolomite.
Do.	LEEDS MINE.	Tin.	Cassiterite.
Do.	NEW HENDRA.	Tin.	Cassiterite.
Do.	Pengelly Croft Mine.	Tin.	Cassiterite, Scheelite.
Do.	PENHALE, HUEL VOR.	Tin.	Cassiterite, Galena, Pyrites.
Do.	Prosper, Huel.	Copper and Tin.	Chalcotrichite, Cuprite, Fahlerz, Mimetite.
Do.	TREMENHEERE.	Tin.	
Do.	Tremearne.	—	Albite, Apatite, Fluor, ORTHOCLASE, Mica, Schorl, Topaz.
Do.	Trescow.	—	Cassiterite, Copper, Chalcopyrite.
Do.	TREWAVAS CLIFF MINE.	Copper.	Chalcopyrite, Chalybite, Fluor.
Do.	Trewavas Head.	—	Albite, Schorl, Mica.

LIST OF MINES, &c.—CORNWALL, KERRIER, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Breage (*Cont.*)	Tregoning Hill.	—	KAOLIN, PINITE.
Do.	Tresowes.	—	Stream Tin, Jasper, KAOLIN.
Do.	VOR, GRT. HUEL.	Tin and Copper.	Albite, Apatite? Blende, Cassiterite, Chlorite, Chalcopyrite, Copper, Dolomite, Melaconite, Mica, Mispickel, Orthoclase, Pyrites, Steatite, Talc? Wolfram?
Germoe.	GREAT WORK CONSOLS.	Tin and Copper.	Blende, CASSITERITE, Chlorite, Chalcopyrite, Cuprite, Fahlerz, Limonite, Melaconite, Mica, Pyrites, Tourmaline.
Do.	LEEDS and ST. AUBYN.	Tin.	Cassiterite.
Do.	Christopher, Huel	Tin.	Cassiterite, Mica, Orthoclase.
Do.	Fortune, South Huel.	Tin.	Cassiterite.
Sithney.	Prospidnick, Huel	Lead.	Chlorite, Pyrites, Wolfram.
Do.	Penrose, Huel.		Anglesite, Calcite, Cerussite, Chalcopyrite, Chalybite, Galena, Limonite, Linarite, Mimetite, Pyrites, PYROMORPHITE, Plumbic Ochre.
Do.	Rose, Huel.	Lead.	Anglesite, Cerussite, Chalybite, Galena, Limonite, Pyromorphite, Quartz.
Do.	Sithney, Carnmeal.	Tin.	Cassiterites, Pyrites.
Do.	Susan, Huel.	Tin and Copper.	Chalcopyrite, Copper, Cassiterite, Mica.
Do.	Trannack, Huel.	Copper.	Cassiterite, Chalcocite, Chrysocolla, Chalcopyrite, GARNET, Mica, Pyrites, Schorl.
Do.	Unity, Huel.		Cerussite, Chalcopyrite, Galena, Pyrites.
Do.	Vor, East Huel.	Tin.	Cassiterite, Chalcopyrite, Malachite.
Wendron.	Ann, Huel.	Tin.	Argentite, Cassiterite, Cerussite, Felspar, Limonite, Mica, Silver.
Do.	BALMYNHEAR.	Tin.	Cassiterite.
Do.	BASSET and GRYLLS.	Tin.	
Do.	Hallebezac.		Cassiterite, Kaolin.
Do.	LOVELL CONSOLS.	Tin.	
Do.	LOVELL, EAST HUEL.	Tin.	CASSITERITE.
Do.	LOVELL, NEW HUEL.	Tin.	Cassiterite.
Do.	LOVELL, NORTH.	Tin.	Cassiterite.
Do.	TREVENNEN, NEW	Tin.	Cassiterite.
Do.	TREWORLIS.	Tin and Copper.	Cassiterite, Chalcocite, Chalcopyrite, Magnetite, Mispickel, Pyrites.
Do.	TRUMPET CONSOLS.	Tin.	Cassiterite, Felspar, Limonite, Mica.
Do.	TRUMPET, EAST.	Tin.	Cassiterite.

LIST OF MINES, &c.—CORNWALL, KERRIER, *East Division*.

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Gwennap.	Ale and Cakes.	Copper.	CHALCOPYRITE.
Do.	Barrier Mine.		Stannite.
Do.	CLIFFORD, NEW.	Tin and Copper.	Cassiterite.
Do.	Consolidated Ms.	Copper.	BARYTES, Cassiterite, Chalcocite, Chalcopyrite, Copper, Cuprite, Gypsum, Melaconite, Molybdenite, Orthoclase, Pyrites, Rock Crystal, Schorl.
Do.	Damsel, East Huel.	Copper.	Chlorite, Chalcocite, Chalcopyrite, Copper, Fluor, Kaolin, Lithomarge, Melaconite, Pharmacosiderite, Pyrites.
Do.	DAMSEL, WEST HUEL.	Tin.	Cassiterite, Fluor.
Do.	Fortune, Huel.	Copper.	Chlorite, Chalcopyrite, Felspar, Limonite, Pyrites, Schorl.
Do.	Friendship, Huel		Albite, Blende, Molybdenite, Wolframite.
Do.	Gerland, Huel.	Copper.	Asbolane, Chalcophyllite, Chalcopyrite, Chalcotrichite, Chessylite, Chrysocolla, CLINOCLASE, Copper, Cuprite, Fluor, LIROCONITE, Malachite, Mimetite, Molybdenite, OLIVENITE, Opal, PHARMACOSIDERITE, SCORODITE Torbernite, Vivianite.
Do.	Jewel, Huel.		Blende, Chalcocite, Chalcopyrite, Fluor, Melaconite, Mispickel, Petroleum? Pyrites, Tennantite.
Do.	Killiwerris.		Chalcopyrite, Galena.
Do.	PENNANCE.	Copper.	Chlorite, Chalcopyrite, Erubescite.
Do.	Penstruthal and Huel Buller.	Copper and Tin.	
Do.	Ting Tang.		Chalcocite, Chalcopyrite, Chalcophyllite, Chessylite, Chlorite, Chrysocolla, Clinoclase, Cuprite, Limonite, Malachite, Melaconite, Melanterite, Olivenite, Pitchblende, PHARMACOSIDERITE, Lithomarge, Pyrites, Torbernite, Orthoclase.
Do.	TRESAVEAN and TRETHARRUP.	Tin and Copper.	Blende, Chalcocite, Chalcopyrite, Chlorite, Copper, Epidote? Erubescite, Fahlerz, Fluor, Galena, Goslarite, Hornblende, Magnetite, Melaconite, Pyrites, Tennantite.
Do.	Trethellan.	Copper.	Chalcocite, Goslarite.
Do.	United Mines.	Copper.	Cassiterite, BARYTES, Rock Crystal.
St. Day.	POLDICE.	Tin.	Bitumen, Cassiterite, Copper, Chalcopyrite, Galena, Pyrites, Sulphur? Wolfram, Wolframite.

LIST OF MINES, &c.— CORNWALL, KERRIER, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Day (*Con.*)	Vogue.	—	KAOLIN.
Gluvias.	ROSCROW UTD.		Chlorite, Mispickel, Pitchblende.
Do.	Burnt House.	—	Magnetite.
Do.	Treluswell.	—	Adularia? Hornblende.
Perran-ar-worthal.	Kerjiliack.	—	Graphite, in an elvan.
Constantine.	CONSTANTINE MINE.	Iron.	LIMONITE.
Do.	LOVELL, NEW EAST HUEL.	Tin.	Cassiterite.
Do.	Granite Quarries	—	Fine imbedded crystals of ORTHOCLASE; occasional crystals of Beryl and Topaz, but very rare.
Mawnan.	Cliffs on sea shore	—	Aragonite, Calcite, Chalcopyrite, Oxide of Zinc.
Mabe.	Granite Quarries	—	Fine Orthoclase in the Granite, occasionally Schorl; very rarely Beryl and Topaz.
Budock.	Budock Vean.	—	Bournonite, Galena.
Do.	Maenporth.	—	Rock Crystal, Calcite, Aragonite?
Falmouth.	Swanpool, Mine.	Lead.	Galena, Pyrites, Rock Crystal.
Mylor.	Trefusis, Huel.	Lead.	Galena.

CORNWALL, PYDAR, *West Division.*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Agnes.	Barrow, Huel.	Tin.	Blende, Cassiterite, Scheelite, Pyrrhotite.
Do.	Basset, Huel.	Copper.	Argentite, Copper, Cuprite, Malachite, Pitchblende, Torbernite
Do.	BLUE HILLS.	Tin.	Cassiterite.
Do.	CHARLOTTE, HUEL	Copper.	Cassiterite.
Do.	CHIVERTON, GRT. WEST.	Lead.	Galena.
Do.	Clarence, Huel.	Tin.	Cassiterite, Smaltite.
Do.	Cligga Head.	—	Cassiterite, KAOLIN, Chalcopyrite, Wolfram.
Do.	Coates, Huel.	Tin.	Agnesite, Bismite, CASSITERITE, Mica, Orthoclase; remarkable pseudomorphs of Cassiterite after Orthoclase, Schorl.
Do.	COIT, HUEL.	Tin.	Cassiterite.
Do.	Devonshire, Huel	Tin.	Chalcopyrite, Cassiterite, Fluor, Pyrites.
Do.	FRIENDLY MINES	Tin.	Cassiterite.
Do.	Hallenbeagle and East Downs.	Copper and Tin.	Chalcopyrite, Pyrites.
Do.	James, Huel.		Torbernite, Chalcopyrite.
Do.	Kind, Huel.	Tin.	Apatite, Chalybite, Covellite, Pyrrhotite, Topaz, VIVIANITE.
Do.	KITTY, HUEL.	Tin.	Blende, CASSITERITE, Chalcopyrite, Chlorite.

LIST OF MINES, &c.—CORNWALL, PYDAR, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Agnes. *(Cont.)*	KITTY, WEST HUEL (formerly Huel Rock).	Tin.	Bismite, Cassiterite, STANNITE.
Do.	Music, Huel.	Copper.	Copper, Chalcocite, Chalcopyrite, Cuprite, Malachite.
Do.	PENHALLS.	Tin.	Cassiterite.
Do.	POLBERROW.	Tin.	Cassiterite, Chalcopyrite, Copper.
Do.	Polberrow, West.	Tin and Copper.	Cassiterite, Chalcopyrite, Fluor.
Do.	Polbreen.	Tin.	Cassiterite.
Do.	PRUDENCE, HUEL.		Blende, Chalcopyrite, Towanite.
Do.	Pye, Huel.		Cassiterite.
Do.	Towan, Huel.	Tin.	Blende, Cassiterite, Chalcopyrite, Chalybite, Chlorite, Limonite.
Do.	TOWAN, SOUTH HUEL.	Copper.	Bitumen, Chalcopyrite, Chalybite, Chlorite, Limonite, Pyrites.
Do.	TOWAN, NEW HUEL.	Tin and Copper.	Cassiterite, Chalcopyrite, Pyrites,
Do.	TREVAUNANCE, HUEL.	Tin.	Cassiterite, Fahlerz, Fluor, Topas.
Perranzabuloe	CHIVERTON (Old Cornubian).	Silver-Lead	Galena.
Do.	CHIVERTON, EAST	Silver-Lead	Galena.
Do.	CHIVERTON MOOR	Silver-Lead	Galena.
Do.	CHIVERTON, NEW (Huel Anna).	Copper, Lead and Zinc.	Blende, Cerussite, Chalcopyrite, Galena.
Do.	CHIVERTON, NEW CONSOLS (Budnick Consols).	Lead, Zinc, Tin.	Blende, Cassiterite, Chalcopyrite, Galena, Pyrites.
Do.	CHIVERTON, GRT. SOUTH.	Lead.	Blende, Chalcopyrite, Dolomite, Galena.
Do.	CHIVERTON UTD.	Lead.	Galena.
Do.	CHIVERTON VALLEY.	Silver-Lead	Galena.
Do.	CHIVERTON, WEST	Lead, Zinc.	BLENDE, CHALCOPYRITE, GALENA.
Do.	Duchy and Peru.	Iron.	Chalcopyrite, Chalybite, Galena, MARCASITE.
Do.	Golden Consols.	Tin.	Cerussite, Galena, Pyromorphite, Rock Crystal, Silver.
Do.	GOLDEN, EAST HUEL.	Lead.	Galena.
Do.	Great St. George.	Copper.	Blende, Calamine, Chalcocite, Chalcopyrite, Copper, Limonite, Melaconite.
Do.	GRT. ST. GEORGE, WEST.		Blende.
Do.	Hope, Huel.	Silver-Lead	BLENDE, GALENA, Chalcopyrite.
Do.	JEWELL, EAST.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	Mexico, Huel.		Argentite, Galena, Kerate, Silver
Do.	MINERAL BOTTOM	Lead.	Galena, Blende.
Do.	Penhale.	Lead.	Galena.
Do.	PERRAN CONSOLS (Huel Vlow).	Tin.	Cassiterite.
Do.	PERRAN HUEL VYVYAN.	Lead.	Galena.

LIST OF MINES, &c.—CORNWALL, PYDAR, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Perranzabuloe *(Cont.)*	PERRAN SAINT GEORGE.	Copper.	Blende, Chalcocite, Chalcopyrite, Copper, Limonite, Melaconite.
Do.	RETALLACK, GRT.	Lead, Zinc.	Blende, Galena, Hornblende, Silver.
Do.	RETALLACK, NTH.		
Do.	VIRGIN, HUEL.	Lead.	Galena, Marcasite,
Cubert.	PENHALE AND LOMAX.	Lead.	Blende, Galena.
Newlyn.	CARGOLL.	Silver-Lead	Blende, Chalcopyrite, Galena, Marcasite.
Do.	Fiddler's Green.	—	
Do.	Rose, Huel.	Lead.	Galena, Pyrites.
Do.	ROSE AND CHIVERTON.	Lead.	Blende, Galena.
Crantock.	TREREW.	Lead.	Galena.

CORNWALL, PYDAR, *East Division.*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Enoder.	CHYTANE.	Tin and China-clay.	Cassiterite, KAOLIN.
St. Columb.	ROYALTON.	Tin.	Cassiterite.
Do.	TREWORLOCK.	Lead.	Galena.
Do.	Trugoe.		Bismuth, Erythrite, Jasper, Opal.
Lanivet.	MULBERRY HILL.	Tin.	Cassiterite.
Do.	RETIRE.	Iron.	Hematite, Limonite.
Do.	REPERRY.	Tin.	Antimonite, Berthierite, Cassiterite, Cervantite, Jamesonite.
Padstow.	ST. ISSEY.	Copper, Lead.	Chalcopyrite, Galena.
Do.	TRELEATHER, NORTH.	Copper, Silver-Lead.	Chalcopyrite, Galena.
St. Merryn.		—	Bournonite.

CORNWALL, POWDER, *West Division.*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Feock.	Carnon Stream Works.	—	CASSITERITE, GOLD.
St. Kea.	CREEGBRAWSE & PENKIVELL.	Copper and Tin.	Chalcopyrite, Cassiterite, PYRITES.
Do.	Falmouth, Huel.	Silver-Lead, and Manganese.	Blende, Cassiterite, Cerussite, Chlorite, Erubescite, Galena, Pharmacosiderite, PYRITES, Pyromorphite, Silver, VIVIANITE.

LIST OF MINES, &c.—CORNWALL, POWDER, *West Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Kea *(Con.)*	JANE, HUEL.	Silver-Lead, Tin.	Annabergite, Beraunite, Blende, Cerussite, Chalybite, Galena, Melanterite, NICCOLITE, PENTLANDITE, Pharmacosiderite, PYRITES, VIVIANITE.
Do.	Jane, West Huel.	Tin.	Cassiterite.
Do.	NANGILES.	Copper and Tin.	Chalcopyrite, Gold? Pyrites, Sulphur?
Kenwyn.	BOSCAWEN.	Copper, Tin, Zinc.	Chalcopyrite, Blende.
Do.	JANE, NORTH.	Tin, Silver-Lead.	Cassiterite.
Do.	Unity Wood, Huel.		Cassiterite, Chalcopyrite, Chlorite, Fluor, Pyrites, Schorl.
St. Erme.	Garras.	Lead.	ALLOPHANE, Blende, Calcite, Dolomite, Galena.
Ladock.		—	Cassiterite, Gold, Hematite, Limonite, Pyrites.
Veryan.	Pennare Point.	—	Asbestos, Hornstone, Steatite.

CORNWALL, POWDER, *East Division.*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Dennis.	Hendra.	—	Mica.
Do.	—	—	Kaolin, Cassiterite.
St. Stephens.	CROW HILL, NEW	Lead.	Galena, Gold? Pyrites.
Do.	Dowgas.	—	Actinolite, Cassiterite, Hornblende, Kaolin, Pyrites, Schorl.
Do.	FORTESCUE, HUEL		
Do.	GRENVILLE, HUEL	Tin.	Cassiterite.
Do.	Terras.	Tin.	Kaolin, Cassiterite.
Gorran.	Gorran Haven.	—	Calcite.
St. Ewe.	CHANCE, HUEL.		ANNABERGITE, Chalybite, Millerite, Niccolite.
Do.	Pengelly Mine.		ANNABERGITE, Chalybite, Millerite, Niccolite.
St. Mewan.	Brecon, Carn.	—	Cassiterite, Gold, Silver.
Roche.	BEAM MINE.	Tin.	Cassiterite, Kaolin, Melaconite, Olivenite, Pharmacosiderite, Talc, Wolfram, Wavellite?
Do.	BRYNN MINE.	Tin.	Cassiterite.
Do.	BRYNN ROYALTON	Tin.	Cassiterite.
Do.	Cost all Lost.	—	Bismite, Cassiterite.
Do.	ROYALTON, GRT.	Tin.	Cassiterite.
St. Austell.	CARCLAZE.	Tin and Kaolin.	Cassiterite, Galena, Gilbertite, KAOLIN, Schorl.
Do.	Carvath United.	Copper and Tin.	Chalcocite, Cuprite.
Do.	CHARLESTOWN UTD. MINES.	Tin and Copper.	Actinolite, Cassiterite, Chalybite, Limonite, Serpentine?
Do.	CONSOLIDATED, ST. AUSTELL.		Annabergite, Barytes, Cobaltite, Copper, Pitchblende, Smaltite.

LIST OF MINES, &c.—CORNWALL, POWDER, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals
St. Austell *(Cont.)*	Crinnis.	Copper.	Chalcopyrite, Chalybite, Childrenite, Copper, FAHLERZ, Galena, Scorodite, Silver, Pyrites.
Do.	CUDDRA.	Tin.	Cassiterite.
Do.	ELIZA, HUEL.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	ELIZA CONSOLS, HUEL.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	GOONBARROW.	Tin and Kaolin.	Cassiterite, Kaolin, Zippæite?
Do.	GOVER.	Tin.	Cassiterite.
Do.	GREAT DOWGAS.	Tin.	Bismuth, Bismuthinite, Cassiterite, Copper, Fluor.
Do.	Grt. Hewas Utd.	Tin.	Cassiterite, Lirocconite, Mispickel.
Do.	Hill Mine.	Tin.	Cassiterite, Orthoclase, Tourmaline, Topaz.
Do.	MINEAR DOWNS.	—	Cassiterite.
Do.	Pembroke.	Copper.	Chalybite, Chalcopyrite, Chalcocite, Copper, Kaolin, Melaconite, Pyrites.
Do.	Pentewan.	—	Stream Tin, Gold.
Do.	POLGOOTH.	Tin.	Amethyst, Calcite, Cassiterite, Chalcopyrite, Chlorite, Dolomite Erythrite, Pyrites, Smaltite.
Do.	POLMEAR, HUEL.	Copper and Pyrites.	Chalcopyrite, Pyrites.
Do.	ROCK HILL.	Tin.	Cassiterite.
Do.	RUBY & KNIGHTOR.	Iron.	LIMONITE, Hematite, Black Quartz.
Do.	SHILTON (Bonney).	Tin.	Cassiterite.
Do.	Stenna Gwynn.	Tin.	Apatite, Autunite, Cassiterite, FLUELLITE, FLUOR, Gilbertite, Mesolite? Natrolite, Opal, Stannite, Talc, Tavistockite, Torbernite, Wavellite? Wolfram.
Do.	Trenanon.	—	Blende.
Do.	Virgin, Huel.	Tin.	Cassiterite.
St. Blasey.	East Crinnis.	Copper.	Blende, Chalcocite, Chalcopyrite, Chalybite, Copper, Melaconite, Pyrites, Rock Crystal.
Do.	PAR CONSOLS.	Copper and Tin.	Blende, Cassiterite, Chalcopyrite, Chlorite.
Do.	PEMBROKE, NEW.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	PEMBROKE, OLD.	Copper.	Chalcopyrite.
Tywardreath.	Fowey Consols. (Lanescot.)	Copper.	Actinolite, Antimonite, Apatite, Bismuthinite, Blende, Calamine, Chalcocite, Chalcopyrite, Chalcotrichite, Chalybite, Cobaltite, Copper, Cuprite, FRANCOLITE, Niccolite, Magnetite, Marcasite, Melaconite, Melanterite, Millerite, Pyrites, Silver, Stannite, Wood Tin.
Do.	FOWEY CONSOLS, SOUTH.	Copper.	Chalcopyrite.

LIST OF MINES, &c.—CORNWALL, POWDER, *East Division (Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Fowey.	Menabilly.	—	Molybdenite.
Luxulyan.	Luxulyan, Quarries near.	—	ORTHOCLASE, SCHORL.
Lanlivery.	MAUDLIN MINES.	Copper and Tin.	Calcedony, Cassiterite, Chalybite, Chlorite, Covellite, Cronstedtite, Fluor, Garnet, Jasper, Melanterite, Mispickel, Opal, Pyrites, Pyrrhotite, Scheelite, Wolfram.
Do.	Prideaux Wood Mine.	Tin.	Cassiterite.
Lostwithiel.	FORTESCUE, NTH. HUEL.	Lead.	Galena.
Do.	RESTORMEL.	Iron.	AGALMATOLITE, Amethyst, Barytes, Bismuth, Bismite, Goethite, Hematite, LIMONITE, Manganite, PSILOMELANE, Pyrolusite, Rock Crystal, Zippæite.
Do.	Terrace Hill Quarry.	—	Axinite.

CORNWALL, TRIGG.

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Minver.	Pentire Glaze.	—	Antimonite, CERUSSITE, Cervantite, Pyrolusite.
Endellion.	Boys, Huel.		Antimonite, BOURNONITE, Cervantite, Erubescite, Jamesonite, Mimetite.
Do.	Port Isaac.	—	Antimonite, Cervantite, Jamesonite.
Do.	Port Quin Cliffs.	—	Jamesonite.
Do.	ROYAL SAMPSON.	Silver-Lead.	Galena.
Do.	Trevinnock.	—	Bleinierite, Cervantite, Jamesonite.
St. Kew.	Pendogget.	—	Anglesite, Antimonite, Jamesonite.
Do.	PENGENNA.	Lead.	Galena.
Bodmin.	Bodmin Moor.	—	Stream Tin.
Do.	ESTHER UNITED, HUEL.	Tin.	Cassiterite.
St. Breward.	ONSLOW CONSOLS, GREAT.	Copper.	Chalcopyrite.
St. Teath.	ARCHIE, HUEL.	Copper, Lead	Chalcopyrite, Galena.
Do.	OLD TREBURGETT	Lead, Silver.	Blende, Chalcopyrite, Pyrites, Polytelite.
Do.	TREGARDOCK.	Lead, Copper	Chalcopyrite, Galena.

LIST OF MINES, &c.—CORNWALL, WEST.

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
St. Veep.		—	Asbestos.
Lanreath.	HERODSFOOT.	Silver-Lead.	Bournonite, CALCITE, Chalcopyrite, Fahlerz, Galena, Hornstone, Pyrites.
Duloe.	HERODSFOOT, SOUTH.	Silver-Lead.	Calcite, Galena.
Liskeard.	AMBROSE LAKE.	Tin.	Cassiterite.
Do.	Looe Mills Hill Quarry.	—	Anatase.
Do.	St. Neot.	Tin.	Cassiterite.
St. Cleer.	CARADON CONSOLS.	Copper.	Chalcopyrite, Cuprite.
Do.	CARADON, SOUTH.	Copper.	Chalcocite, Chalcopyrite, Cuprite, Fluor.
Do.	CARADON, WEST.	Copper.	Chalcocite, Chalcopyrite, Cuprite, Copper, Fluor.
Do.	Cheesewring.	—	Actinolite, Asbestos, Orthoclase, Soapstone? Schorl.
Do.	CRADDOCK MOOR.	Copper.	Chalcopyrite, Cuprite.
Do.	GLASGOW CARADON CONSOLS.	Copper.	Chalcopyrite, Cuprite.
Do.	GONAMENA.	Copper.	Chalcopyrite, Cuprite.
Do.	Ludcott, Huel.		Pyrargyrite, Silver.
St. Neot.	HAMMETT.	Tin.	Cassiterite.
Do.	TIN VALLEY.	Tin.	Cassiterite.
Do.	TREVENNA, HUEL	Tin and Copper.	Cassiterite, Chalcopyrite.
Warleggan.	GRT. TREVEDDOE AND CABILLA.	Tin.	Cassiterite.

CORNWALL, LESNEWTH.

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Tintagel.	Cliffs.	—	Albite, Anatase, ARAGONITE Brookite?
Do.	DELABOLE SLATE QUARRIES.	—	Adularia, Albite, Anatase, Calcite, Goethite, ROCK CRYSTAL, Rutile?
Do.	KING ARTHUR MINE.	Silver-Lead.	Galena.
Forrabury.	Cliffs.	—	Anthracite.
Do.	Boscastle.	—	Graphite.
Davidstow.		—	Hematite, Limonite.
Laneast.	Lettcott.	—	Manganite, Psilomelane.
Alternun.		—	Stream Tin, Gold.

LIST OF MINES, &c.—CORNWALL, EAST.

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Launceston.	Five Lanes.	—	Hornblende.
Do.	Pollaphant.	—	Calcite, Serpentine, STEATITE.
Callington.	Creva Wood.	—	Pyrolusite.
Do.	COLQUITE AND CALL. UTD.	Copper.	Chalcopyrite.
Do.	Duchy Huel.		Argentite, Kerate, Pyrargyrite, Silver.
Do.	DEER PARK.	Tin.	Cassiterite.
Do.	EXCELSIOR.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	George and Charlotte.	—	Bismuthinite, Childrenite, Chlorite.
Do.	FLORENCE, HUEL.	Copper.	Chalcopyrite.
	HAYE VALLEY.	Tin.	Cassiterite.
Do.	HOLMBUSH AND KELLY BRAY.	Copper.	Chalcopyrite.
Do.	KELLY BRAY.	Silver-Lead.	Chalcopyrite, Galena.
Do.	NEW GREAT CONSOLS.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	PRINCE OF WALES SOUTH.	Copper.	Chalcopyrite.
Do.	PRINCESS OF WALES.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	REDMOOR.	Copper.	Cassiterite, Chalcopyrite.
Do.	St. Vincent, Huel.		ARGENTITE, Chalcopyrite, KERATE, SILVER.
St. Ive.	CARADON, GRT.	Copper.	Chalcopyrite.
Do.	GILL, HUEL.	Copper and Lead.	Chalcopyrite, Galena.
Do.	GILL, GLASGOW HUEL.	Lead.	Galena.
Do.	IDA, HUEL.	Silver-Lead.	Galena.
Do.	TRELAWNEY, NEW.	Copper.	Blende, Barytes, Chalcopyrite, Galena, Fluor, Hornstone.
Linkinhorne.	CARADON, EAST.	Copper.	Chalcopyrite, Cuprite.
Do.	CARADON AND PHŒNIX.	Copper and Zinc.	Blende, Chalcopyrite.
Do.	MARKE VALLEY.	Copper.	Chalcopyrite, Cuprite.
Do.	PHŒNIX.	Copper and Tin.	Cassiterite, Chalcopyrite, Chalcotrichite, CUPRITE, Copper, Chrysocolla, Malachite, Olivenite.
Do.	PHŒNIX, EAST.	Copper.	Chalcopyrite.
Do.	PHŒNIX, WEST.	Copper.	Chalcopyrite.
Do.	Rose Down, West	Copper.	Chalcopyrite.
Stokeclimsland.	KITT HILL.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	KITT HILL, EAST.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	KITT HILL, STH.	Tin.	Cassiterite.
Calstock.	ARTHUR, HUEL.	Copper and Tin.	Bismuthinite, Cassiterite, Chalcopyrite.
Do.	Brothers, Huel.	Copper.	ARGENTITE, Blende, Chalybite, Galena, PYRARGYRITE, SILVER.
Do.	CALSTOCK CONSOLS.	Copper.	Chalcopyrite.

LIST OF MINES, &c.—CORNWALL, EAST *(Cont.)*

Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Calstock *(Cont.)*	DRAKEWALLS.	Tin and Copper.	Cassiterite, Molybdenite, Wolfram, Wolframite.
Do.	DRAKEWALLS, WEST.	Tin.	Cassiterite.
Do.	GUNNISLAKE.	Copper.	Antimonite, Chalcocite, Chalcophyllite, Chrysocolla, Copper, Cuprite, Cyanosite, Libethenite, Liroconite, Malachite, Melaconite, Olivenite, Torbernite, Wolfram.
Do.	GUNNISLAKE CLITTERS.	Copper and Tin.	Chalcopyrite.
Do.	HAREWOOD CONSOLS.	Copper.	Chalcopyrite.
Do.	HAWKMOOR.	Copper.	Chalcopyrite.
Do.	HINGSTON DOWNS.	Copper.	Chalcopyrite.
Do.	Lee, Huel.		Antimonite, Cervantite, Galena, Jamesonite.
Do.	OKEL TOR.	Copper.	Chalcopyrite.
Do.	PRINCE OF WALES	Copper and Tin.	Chalcopyrite.
Do.	PRINCE OF WALES, WEST.	Copper.	Chalcopyrite.
Menheniot.	Clicker, Tor.		Asbestos, Calcite, Serpentine.
Do.	MARY ANN, HUEL.	Silver-Lead.	BARYTES, Calcite, Pyrites, Rock Crystal.
Do.	TRELAWNY, HUEL	Silver-Lead.	Barytes? Calcite, Galena.
Do.	Treweatha.	Silver-Lead.	Galena.

DEVONSHIRE.

(In Devon, as the Localities are more widely separated than in Cornwall, they are somewhat arbitrarily arranged.)

SOUTHERN PARLIAMENTARY DIVISION.

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Lifton.	Harris, Huel.	Silver-Lead.	Galena.
Do.	HEALE.	Manganese.	Psilomelane, Pyrolusite.
Do.	Henry, Huel.	Manganese.	Psilomelane, Pyrolusite.
Do.	LIFTON MINES.	Manganese.	Psilomelane, Pyrolusite.
Do.	Mary Emma, Huel.	Tin.	Cassiterite.
Lew Trenchard	LEW WOOD.	Manganese.	Psilomelane, Pyrolusite.
Okehampton.		—	Amethyst, Andalusite, Axinite, Chiastolite? Jasper, Opal, Rock Crystal, Schorl,
Do.	BELSTONE CONS.	Copper.	Chalcopyrite, Garnet, Limonite.
Do.	Maria, East Huel.	Copper.	Chalcopyrite.
Do.	Copper Hill.		Axinite, Garnet.
Do.	FOREST HILL.	Tin and Lead.	Axinite, Cassiterite, Galena, Garnet.
Do.	FURSDON MINE.	Copper.	Axinite, Chalcopyrite, Garnet.
Do.	Holstock.		Chiastolite?
Do.	Ivey Tor.	Copper.	Axinite, Bismuthinite, Chalcopyrite, Marcasite.
Do.	Meldon Quarry.	—	Garnet, Pyrrhotite.
Do.	Sticklepath.	—	Actinolite, Axinite, Hornblende.
Do.	Zeal Consols, Sth.	Copper.	Chalcopyrite.
Lidford.	Frederick, Huel.	Tin.	Cassiterite.
Do.	Lidford Consols.	Tin.	Cassiterite.
Do.	Swincombe Vale.	Tin.	Cassiterite.
Marystow.	ALLIFORD.	Manganese.	Psilomelane, Pyrolusite.
Do.	CALLACOMBE.	Copper and Blende.	Blende, Chalcopyrite.
Do.	Dippertown.	Manganese.	Psilomelane, Pyrolusite.
South Sydenham.	Concord.	Silver-Lead & Copper.	Chalcopyrite, Galena.
Milton Abbot.	CAWSAND VALE.	Copper.	Chalcopyrite.
Do.	Chillaton.	Manganese.	Psilomelane, Pyrolusite.
Do.	Hogston.	Manganese.	Psilomelane, Pyrolusite.
Lamerton.	CALLACOMBE, EST.	Copper.	Chalcopyrite.
Do.	CARDWELL.	Manganese.	Psilomelane, Pyrolusite.
Do.	MARIA, WEST & FORTESCUE.	Copper and Lead.	Chalcopyrite, Galena.
Mary Tavy.	Betsy, South Huel.	Copper and Lead.	
Do.	Devon Huel Union.	Copper.	
Do.	FRIENDSHIP, HUEL.	Copper.	Axinite, Blende, Calcite, CHALCOPYRITE, Chalybite, Chlorite, Fluor, Galena, Pyrites, ROCK CRYSTAL, Scheelite, Wolfram?
Do.	Friendship, Nth. Huel.	Copper and Lead.	Chalcopyrite, Galena.
Do.	Peter Tavy and Mary Tavy Cns.	Copper.	Chalcopyrite.

LIST OF MINES, &c.—DEVONSHIRE, SOUTHERN DIVISION *(Cont.)*

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Mary Tavy *(Cont.)*	PRINCE ARTHUR CONSOLS (Old Huel Betsy.)	Silver-Lead.	Chalybite, Galena, Limonite, Vivianite.
Tavistock.	BEDFORD CONLS.	Copper.	Chalcopyrite.
Do.	BEDFORD UNITED.	Copper.	Chalcopyrite, CHALCOTRICHITE, Chalybite, Clinoclase, CUPRITE, Olivenite, Pyrites, Torbernite.
Do.	Black Down.	—	Niccolite, PSILOMELANE, PYROLUSITE, Rhodonite.
Do.	Brent, Tor.	—	Actinolite, Axinite, Garnet, Jasper, Psilomelane, Pyrolusite.
Do.	COURTNEY, HUEL.	Copper.	Chalcopyrite.
Do.	CREBOR.	Copper.	Bitumen, Chalcopyrite, Chalybite, Childrenite, Chlorite, Copper.
Do.	CRELAKE.	Copper.	Chalcopyrite.
Do.	Crowndale.	Copper.	Chalcopyrite, Marcasite.
Do.	DEVON & CORNWALL UNITED.	Copper.	Antimonite, Bismuthinite, Chalcopyrite, Childrenite, Chlorite.
Do.	Devon & Courtenay.	Copper.	CHALCOPYRITE, Copper, Galena.
Do.	DEVON GREAT CONSOLS.	Copper.	CHALCOPYRITE, Copper, Mispickel
Do.	Devon Gt. Consols, East.	Copper.	Chalcopyrite.
Do.	Gawton.	Copper.	Chalcopyrite.
Do.	GUNNISLAKE, EAST, & SOUTH. BEDFORD.	Copper.	Chalcopyrite.
Do.	NEW GT. CONSLS.	Copper.	Chalcopyrite.
Do.	RUSSELL, HUEL.	Tin.	Cassiterite.
Do.	Russell, Est. Huel	Copper.	Chalcopyrite.
Do.	RUSSELL, NEW EAST HUEL.	Copper.	Chalcopyrite.
Do.	Tavy Consols.	Copper.	Chalcopyrite.
Do.	United Mines.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	Willsworthy Mine.		CHALCOPYRITE, Erythrite, Silver.
Bickleigh.	Bickleigh Vale, Huel Phœnix.	Copper and Tin.	Cassiterite, Chalcopyrite.
Sampford Spiney.	Huckworthy Bridge.	Copper.	Chalcopyrite.
Do.	Robert, Huel.	Copper.	CHALCOPYRITE, Limonite, Pyrites, Rock Crystal.
Do.	Robert, North Huel.	Copper.	Chalcopyrite.
Prince Town.	WHITE WORKS.	Tin.	Cassiterite.
Buckland Monachorum.	Buller & Bertha.	Copper.	Chalcopyrite.
Do.	Bertha, East.	Copper.	Chalcopyrite.
Do.	Devon Poldice.	Tin & Cop.	Cassiterite, Chalcopyrite.
Do.	Devon Huel Buller.	Copper.	Chalcopyrite.
Do.	Franco, Huel.	Copper.	Cassiterite, Chalcopyrite, Chalybite, Fluor, FRANCOLITE.

LIST OF MINES, &c.—DEVONSHIRE, SOUTHERN DIVISION *(Cont.)*

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Buckland Monachorem *(Cont.)*	Lady Bertha.	Copper.	Chalcopyrite.
Do.	Lady Bertha, South.	Copper.	Chalcopyrite.
Do.	VIRTUOUS LADY.	Copper.	Anatase, Brookite? CHALCOPYRITE, Chalybite, Chlorite, Fluor, MARCASITE, Mispickel, Pyrites, Titanite.
Beerferris.	Beeralston Mines.	Silver-Lead.	Anglesite, Blende, Bournonite, Calcite, Calcedony, Chalcopyrite. Chalybite, Dolomite, Fahlerz, FLUOR, Galena, Hornstone, Mimetite, Pyromorphite, Pyrrhotite.
Do.	Queen of Tamar.	Copper and Lead.	Chalcopyrite, Galena.
Do.	South Hooe.		Dolomite, Fluor.
Do.	SOUTH WARD.	Silver-Lead.	Galena.
Do.	Tamar Consols.	Silver-Lead.	Blende, Cassiterite, CHALCOPHYLLITE, Fluor, Galena, MARCASITE, Mispickel, Rock Crystal.
Do.	Tamar, East.	Lead.	Anglesite, Cerussite, Chessylite, Galena, Hornstone, Malachite.
Do.	TAMAR VALLEY.	Silver-Lead.	Galena.
Whitchurch.	Sortridge Consls.	Copper.	Chalcopyrite.
Plymouth.	Many Quarries.	—	CALCITE.
Plympton.		—	Chalybite, Kaolin.
Do.	BOTTLE HILL, EAST.	Tin.	Cassiterite.
Do.	MARY HUTCHINGS HUEL.	Tin.	Cassiterite.
Do.	Shaugh.	Iron.	Chalybite, Limonite.
Do.	Sydney, Huel.	Tin.	Cassiterite.
Ivybridge.		—	Chiastolite? Orthoclase.
Dartmoor.		—	Andalusite? Cassiterite, Garnet, Hematite, Hornblende, Tourmaline.
Do.	Haytor,	—	Agate, Calcedony, Garnet, Haytorite, Hornblende, Magnetite, Orthoclase, Opal.
Do.	Sheepstor.	—	Cassiterite, Gold.
Buckfastleigh.		—	Aragonite, Hematite, Limonite, Malachite.
Do.	BROOKWOOD.	Copper.	Chalcopyrite.
Do.	EMMA, HUEL.	Copper.	Chalcopyrite.

LIST OF MINES, &c.—DEVONSHIRE, EAST DIVISION.

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Chagford.	VITIFER CONSOLS, NEW.	Copper.	Chalcopyrite, Schorl.
Moreton-hempstead.	Gidleigh.	—	Rock Crystal.
Christow.	EXMOUTH.	Copper and Silver-Lead.	Chalcopyrite, Galena.
Do.	Exmouth, North Huel.	Copper and Silver-Lead.	
Do.	Exmouth, South Huel.	Silver-Lead.	
Do.	FRANK MILLS.	Silver-Lead.	Galena.
North Bovey.	BIRCH TOR, NEW and VITIFER.	Tin.	Cassiterite.
Do.	Birch Tor, East.	Tin.	Cassiterite.
Do.	King's Oven.	Tin.	Cassiterite.
Bovey Tracey.		—	Apatite, Diallogite, Hornblende, LIGNITE, Lithomarge, Mica, Orthoclase, RETINITE, TOURMALINE.
Do.	DEVON HUEL FRANCES.	Copper.	Chalcopyrite.
Do.	Yarner.	Copper and Mundic.	Chalcopyrite, Pyrites.
Lustleigh.		—	Beryl, Garnet, Hermatite, Opal.
Ilsington.	Atlas.	Tin & Iron.	Cassiterite, Limonite.
Do.	Hatherley.	Iron.	Limonite, Magnetite.
Do.	Sigford.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	Smallacombe.	Iron.	Limonite, Hematite.
Ashburton.	Ashburton Cons.	Copper.	Chalcopyrite.
Do.	Ashburton Mine.		Cassiterite.
Do.	Ashburton Untd.	Tin and Copper.	Cassiterite, Chalcopyrite.
Do.	Ashburton, West.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	Buckland in the Moor.	—	Magnetite.
Do.	Devon Gt. Huel Ellen.	Copper and Tin.	Cassiterite, Chalcopyrite.
Do.	Devon, New.	Copper.	Chalcopyrite.
Do.	Smith's Wood.	Tin.	Cassiterite.
Do.	United, Dart.	Copper.	Chalcopyrite.
Do.	VICTORIA (Arundel.)	Copper.	Chalcopyrite.
Do.	Victoria, New.	Copper.	Chalcopyrite.
Torquay.	Babbicombe Bay.	—	BARYTES, Beekite, Calcite.
Do.	Mary Church.	—	Agate.
Do.	Torbay.	—	Aragonite, BEEKITE.
Do.	Torbay Mine.	Iron.	Hematite, Limonite.
Paignton.	GYMTON.	Iron.	Hematite, Limonite.
Brixham.	FIVE ACRE.	Iron.	Hematite, Limonite.
Do.	PROSPER, HUEL.	Iron.	Hematite, Limonite.
Do.	PARKINS.	Iron.	Hematite, Limonite.
Do.	SHARPHAM.	Iron.	Hematite, Limonite.
Dawlish.		—	Calcite, MURCHISONITE.
Chudleigh.		—	Apatite, Kalinite, Petroleum, Psilomelane, Schorl.

LIST OF MINES, &c.—DEVONSHIRE, EAST DIVISION *(Cont.)*

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Chudleigh *(Cont.)*	Hennock.	—	BARYTES, Blende, Cerussite, Galena, Hematite, Malachite.
Exeter.	Haldon.	—	Chert, Flint.
Do.	Heavitree.	—	Orthoclase, MURCHISONITE.
Budleigh Salterton.		—	Agate, Orthoclase.
Sidmouth.		—	Celestite, Flint.
Axminster.	Seaton.	—	Asbestos.

DEVONSHIRE, NORTHERN PARLIAMENTARY DIVISION.

Situation or Parish.	Locality.	Produce of Mines.	More remarkable Minerals.
Buckland Brewer.		—	Hematite, Jasper, Limonite.
Do.	Orleigh Court.	—	Chert, Flint, Psilomelane.
Bideford.		—	Anthracite, Hematite, Psilomelane.
Ilfracombe.		—	Aragonite, Hematite, Millerite.
Do.	Combmartin Mines.	Silver-Lead.	Aragonite, Antimonite, Blende, Calcite, Chalcopyrite, Chessylite, Fahlerz, Galena, Hematite, Malachite, Marcasite, Millerite, Pyrites, Rock Crystal, Silver, Umber, Yellow Ochre.
Do.	West Down.	—	Hematite, Psilomelane.
Barnstaple.	Abbotsham.	—	Anthracite.
Do.	Bickington.	—	Pyrites.
Do.	Bishop's Tawton.	—	Pyrites.
Do.	Bratton Fleming.	—	Hematite, Limonite.
Do.	East Down.	—	Hematite, Limonite, Psilomelane, Umber, Yellow Ochre.
Do.	Georgeham.	—	Hematite, Limonite, Psilomelane, Pyrolusite.
Do.	Hawkridge Wood	—	Anthracite.
Do.	Landkey.	—	Blende, Galena.
Do.	Viveham.	—	Hematite, Limonite, Psilomelane, Pyrolusite, Pyrites.
Nth. Moulton.	BAMPFYLDE, NEW	Copper.	Chalcopyrite.
Do.	BRITTANIA and PRINCE REGENT.	Copper.	Chalcopyrite, Erubescite, Fahlerz, GOLD.
Do.	Molland Mine.	Copper.	Chalcopyrite, Fahlerz.
Sth. Moulton.	Filleigh.	—	WAVELLITE.
Newton St. Cyres.		—	Hematite, Psilomelane.
Upton Pyne.		—	Manganite, PSILOMELANE, PYROLUSITE, Rhodonite, Wad.
Collumpton.		—	Anthracite.
Blackdown Hills.		—	Agate, Chert, Flint.
Exmoor.		—	Chalybite, Goethite, Limonite.
Lundy Island.		—	Chalcopyrite, Hornblende, Magnetite, Orthoclase, Rock Crystal, Topaz, Tourmaline.

CHAPTER VI.

PARAGENETIC.

That the composition of a mineral lode often varies with a variation of the enclosing country is a very old observation. The subject was largely considered by Mr. W. J. Henwood, in his great work on the Metalliferous Deposits of Cornwall and Devon; and, although it well deserves further elucidation, this belongs rather to a geological than to a mineralogical work.

A more strict paragenesis would deal with those groups of minerals which are immediately associated with each other, or even in contact; and fortunately such an enquiry may be conveniently prosecuted wherever a well-selected series of mineral specimens exists.

The object of this chapter is rather to draw popular attention to this branch of the subject than to follow it up in detail, as many more observations should be specially made in this direction before any very definite laws can be announced. It is well-known, however, that certain minerals are, to use a miner's term, "congenial" to others; and a few such observations are here set down.

Of all the minerals known in the two western counties, Quartz is the most widely diffused, and most generally associated with other minerals. So general is its occurrence, that its peculiar *varieties* must be studied in order to lead to any definite results.

The following examples of paragenesis will be recognised as common; but it would be well if students would carefully register and accumulate observations on this part of the subject, and make them publicly known through any convenient channel.

QUARTZ	is commonly associated with	Orthoclase.
,,	,,	Mica.
,,	,,	Schorl.
,,	,,	Chlorite.
,,	,,	Chalybite.
,,	,,	Calcite.
,,	,,	Dolomite.
,,	,,	Barytes.
,,	,,	Fluor.
,,	,,	Cassiterite.
,,	,,	Pyrites.
,,	,,	Chalcopyrite.
,,	,,	Limonite.
,,	,,	Goethite.
,,	,,	Wolfram.
,,	,,	Cuprite.
,,	,,	Copper.
,,	,,	Galena.
,,	,,	Blende.
,,	,,	Bournonite, &c.
CASSITERITE	,,	Chlorite.
,,	,,	Mispickel.
,,	,,	Pyrites, &c.
CHALCOPYRITE	,,	Fluor.
,,	,,	Galena.
,,	,,	Blende.
,,	,,	Chalybite.
,,	,,	Dolomite, &c.
GALENA	,,	Pyrites.
,,	,,	Chalcopyrite.
,,	,,	Blende, &c.
PYRITES	,,	Fluor.
,,	,,	Mispickel.
,,	,,	Limonite, &c.

CUPRITE	is commonly associated with	Copper.
,,	,,	Malachite.
,,	,,	Chessylite, &c.
FLUOR	,,	Wolfram.
,,	,,	Chlorite.
,,	,,	Orthoclase.
,,	,,	Chalybite, &c.
SERPENTINE	,,	Steatite.
,,	,,	Diallage.
,,	,,	Asbestos.
,,	,,	Chrysocolla, &c.

Besides the above, many notices of associated groups of minerals will be found in the alphabetical part of the work.

A HAND-BOOK

TO THE

MINERALOGY OF

CORNWALL AND DEVON.

PART II.

63

A.

Accretion. Increase by external additions of new matter; applied only to inorganic substances.

Acicular. Needle-like. Long, slender, and straight prisms are termed acicular.

Acicular Arseniate of Copper. See Olivenite.

Acid. A substance containing Hydrogen, which is displaceable by a metal—a salt being formed. In some instances it is necessary that the metal be presented in the form of an hydrate. The acids are Hydrogen salts. They have a sour taste, and turn blue litmus paper red.

Adamantine. Diamond-like. A term applied to the *lustre* of some minerals.

Actinolite. See Amphibole.

Adherent. A term applied to a few minerals which absorb moisture so rapidly as to adhere to the moist tongue. *Ex.* Lithomarge.

Adularia. See Orthoclase.

AGALMATOLITE.

[Figure stone. Pagodite.] Amorphous, massive, compact; sectile, but easily broken; fracture splintery or flat conchoidal; opaque to translucent on thin edges; dull; various shades of red, green, yellow, grey, and brown; unctuous; streak white; H. 2-3; G. 2·4-2·9.

B., etc. In matrass gives off water; on C alone turns white; Fus. 5-6, the white residue treated with Co turns blue; with borax forms a colourless bead; insoluble in HCl or HNO_3; the powder is decomposed by warm H_2SO_4.

Comp. It is essentially an hydrated silicate of alumina and potash. No analysis of a British specimen is known to the writer, but in four Chinese specimens the silica ranged from 54·50 to 56·0 per cent., alumina from 29·0 to 34·0, peroxide of iron 0·5 to 1·25; lime 0 to 2·0, potash 5·25 to 7·0, water 3·0 to 5·0. With silica 54·2, alumina 31·0, potash 9·4, and water 5·4, the formula may be written $\dot{K}_2\ddot{3}\ddot{A}l_2\ddot{9}\ddot{S}i\ddot{3}H_2$ (when the oxygen ratio will be as given by Dana—1 : 9 : 18 : 3) or $Si_9O_6Ko_2(Al_2o^{vi})_2Ho_3$.

Loc. Restormel Royal Iron Mines, Lostwithiel, nearly white, or of a flesh red tint. Also Wales, Ireland, Norway, Germany, China, &c.

Obs. Agalmatolite is often much like Steatite and Lithomarge, but it is harder than Lithomarge and less lustrous; and differs from Steatite in the absence of magnesia and the presence of potash. The reaction with "Co" will distinguish between Steatite and Agalmatolite, as Steatite turns red, while Agalmatolite turns blue. (See Blowpipe Reactions.) Dana considers Agalmatolite to be a variety of Pinite. The Restormel mineral has been named Agalmatolite from its external characters alone.

Agate. Agate Jasper. See Calcedony.

Aggregate. A confused crystalline mass.

AGNESITE.

Amorphous; massive, disseminate, investing; or in pseudomorphous acicular crystals; brittle; fracture conchoidal; opaque to translucent on thin edges; lustre vitreous, glimmering, or dull; various shades of green or yellow; streak white or greenish-white; H. 4-4·5; G. 6·9-7.

B., etc. In matrass gives off a little water, decrepitates, turns grey; on C alone melts easily, boils, and is reduced to a grey brittle metallic bead, depositing a dark yellow coating on the charcoal; soluble with effervescence in HNO_3; the

solution turns white on addition of a large quantity of water.

Comp. It appears to be an impure carbonate of bismuth, if the following analysis of a specimen from St. Agnes by Mr. Gregor be reliable :—

Carbonic anhydride	51·3
Sesquioxide of bismuth	28·8
Oxide of iron	2·1
Alumina	7·5
Silica	6·7
Water	3·6
Total	100·0

Thomson states (Min. II., 594) that it "does not effervesce with acids, and contains only a trace of Bi." It may, perhaps, be only an impure bismuth ochre. The author has not been able to procure a specimen for examination.

Loc. St. Agnes, at Huel Coates. A similar mineral is said to have been found at Botallack. It occurs also in Germany.

Alabaster. See Gypsum.

ALBITE.

[Soda Felspar.] Anorthic; with two perfect cleavages, basal (O) and brachydiagonal (M), figs. 174. 175, and 182, forming angles of 93° 36′ and 86° 24′; in variously modified prisms; very often macled; also massive, lamellar, or compact (Felsite); brittle; fracture uneven; transparent to opaque; vitreous or pearly; white, sometimes tinged with yellow, red, green, blue, grey; some specimens shew a bluish opalescence, or a play of colours on the basal cleavage. Streak white; H. 6-7; G. 2·6-2·7.

Var. Cleavelandite is a lamellar white albite. Pericline occurs in large opaque white crystals, which are often short and broad. Compact albite or albitic Felsite, usually contains disseminated grains of silica.

B., etc. In matrass unchanged; on C alone fuses at 4 to a colourless or white glass, turning the flame intensely yellow. It is not acted upon by HCl, HNO_3, or H_2SO_4.

Comp. Albite is an anhydrous silicate of alumina and soda, containing an excess of silica. The soda is often partially replaced by potash and other bases. The following is a recent analysis of a specimen from Trewavas, in Breage, by the Rev. S. Haughton ;—

Silica	65·76
Alumina	21·72
Lime	0·89
Magnesia	trace
Soda	9·23
Potash	1·76
Water	0·40
Total	99·76

The range of composition in specimens from other localities is considerable. The silica varies from 65·4 to 70·0; alumina 18·1 to 21·9; oxide of iron 0 to 2·3; lime 0 to 3·7; magnesia 0 to 1·5; soda 6·2 to 12·2; potash 0 to 6·8. With silica 68·6, alumina 19·6, and soda 11·8, the formula may be written $\dddot{Al}_2NaSi$ (oxygen ratio =1 : 3 : 12), or $Si_6O_8Na_{02}Al_{2^{OVI}}$.

Loc. Huel Friendship, Camelford, on quartz; Tintagel cliffs; Delabole slate quarries, in white crystals like Fig. 182, with scheifer spar and quartz; Trewavas Head, Breage; and other localities in the two counties. An interesting specimen of albite, in very peculiar colourless transparent twinned crystals, was recently found at Huel Metal, in Breage. in the 135 fathom level, by Capt. G. M. Henty. It is now in the British Museum.

Obs. The Rev. S. Haughton observes : —"The granites of Cornwall and Devon, which have been frequently examined by me during the last sixteen years, appear all to contain the two felspars—albite and orthoclase." The presence of albite is thought to be an indication of the eruptive origin of the granites in which it occurs. It is most readily distinguished from orthoclase by the inclination of its cleavages and the intense yellow tinge which it imparts to the blowpipe flame. It is also more fusible than orthoclase, fusing at from 3 to 4.

Angles.

M O =	93°	36′	M y =	149°	12′
M T	117	53	O g	29	55
O T	115	05	O x	52	37
M f	148	30	y o	152	18
M o	67	49	o x	152	41
O O	173	28			

Alkaline. Having the properties of an alkali. The alkalies, potash, soda, ammonia, and lithia have an acrid, caustic taste, and will turn yellow turmeric paper brown, and reddened litmus paper blue. Lime, baryta, strontia, and magnesia possess the same properties in a less marked degree, and are termed alkaline earths.

Alliaceous. An odour resembling that of garlic (*allium*), which is given off when minerals containing arsenic are heated on charcoal. Some give off the odour on being broken.

ALLOPHANE.

Amorphous; mammillary, stalactitic, incrusting, or occasionally pulverulent; brittle; fracture imperfect conchoidal or earthy; translucent to opaque; vitreous,

resinous, or waxy; shining or dull; pale sky blue; sometimes colourless, or grey, green, red, yellow, or brown; streak white; H. 3; G. 1·8-1·9.

B., etc. In matrass yields much water; on C alone crumbles to a white infusible powder, which turns blue when treated with Co; decomposed by HCl, gelatinous silica being deposited.

Comp. It is an hydrous silicate of alumina. No complete analysis of a specimen from the West of England is published, but the composition generally ranges from silica 17·0 to 24·1, alumina 29·2 to 41·0, lime 0 to 1·9, water 35·2 to 44·2. With silica 22·1, alumina 38·0, and water 39·9, the formula may be written $\dot{A}l_2\dot{S}i6\dot{H}_2$ (oxygen ratio = 3:2:6) or $SiHo_2(Al_2Ho_4O_2)''+3OH_2$.

Loc. Garras Mine, near Truro, in greyish translucent reniform masses, very brittle. There is a fine specimen from this locality in the Museum of the Royal Institution of Cornwall at Truro, and another in the Museum of Practical Geology, Jermyn-street, London. Tavistock (near) in beautiful pearly and translucent masses, some tinged blue or green, with a little copper. Also Kent, France, Belgium, Germany, United States, &c.

Obs. Schrotterite is, perhaps, only a variety with less silica. Dana (System of Min., 421, 1868) gives "Cornwall" as a locality for schrotterite, but does not say in what part. He may refer to the mineral found at Garras Mine. The composition of schrotterite ranges from silica 10·5 to 12·0, alumina 46·0, peroxide of iron 0 to 2·95, water 35·5, to 41·0, which is nearly equal to $8\dot{A}l_2\dot{3}Si3\dot{H}_2$.

Alloy. A combination of two or more metals. When mercury is one the alloy is termed an amalgam.

Almandite. Almandine. See Garnet.

Alum. A name for a group of minerals having a great similarity of composition and properties; all are very soluble, all have more or less of the astringent taste of common alum (Kalinite); all are cubical; sulphates; and contain 24 equivalents of water of crystallization; all have the ratio of base and acid, and protoxide to peroxide = 1 : 3.

Alum. See Kalinite.

Alumina is the sesquioxide of aluminium, and is represented by the formula Al_2O_3. In its pure state it is a white powder, and when crystallized forms the mineral corundum, which includes the ruby, the sapphire, and emery. Many minerals which contain alumina, if powdered, heated on charcoal in OF, moistened with a solution of nitrate of cobalt (Co), and again heated, turn to a bright blue colour. This reaction is successful only in the absence of the oxides of iron, manganese, and other heavy metals. If after heating on charcoal without fluxes there remains a white, or nearly white, infusible mass, the experiment is likely to be successful.

Amalgam. See Alloy.

Amethyst. See Quartz.

Amianthus. See Amphibole.

Amorphous. Without form. A term applied to minerals which are not known to crystallize.

AMPHIBOLE.

[Hornblende; &c.] Oblique, in prisms, usually modified, often macled, the faces often curved, or striated, or uneven; cleavage perfect, prismatic; parallel to M. (Fig. 181); the angles formed by the cleavages are 124° 30′ and 55° 30′; in aggregates of long thin prisms; or massive, fibrous, divergent, reticulate; granular, disseminate, or compact; tough, brittle, or flexible; fracture imperfect conchoidal, uneven, or splintery; translucent to opaque; vitreous, pearly, glimmering, or dull; sometimes white, but more usually green, of various shades; or grey, yellow, brown, or black; streak white or slightly brownish; H. 5 to 6 (except asbestos and amianthus, which are soft); G. 2·9-3·4.

Var. 1. Hornblende. Short thick prisms, or massive; usually dark green or almost black; tough.

2. Actinolite, long prismatic aggregates, often divergent or radiate; brittle; usually some dark shade of green.

3. Tremolite, white, grey, or light green bladed crystals, with a pearly lustre, containing much MgO and CaO, and some FeO, with but little Al_2O_3.

4. Asbestos, Amianthus, &c. Generally white, and in fine soft flexible fibres, that are easily separated.

5. Mountain Paper, Mountain Cork, Mountain Wood, &c., in brown felted masses, that will sometimes float on water until finely powdered.

6. Amphibolyte or hornblende rock is massive, dark green or black, with a granular texture. Hornblende schist is similar, but has a slaty structure. Both often contain some albite.

B., etc. In matrass usually unchanged, but sometimes yields a little water; on C alone fuses at from 3 to 4, according to the amount of iron present, to a grey, green, or black bead, the darker ones mostly magnetic; with soda forms a fusible slag; with borax or microc.

generally gives Fe reactions; insoluble in HCl or HNO_3.

Comp. Tremolite is a silicate of magnesia and lime; actinolite and asbestos of magnesia, iron, and lime; hornblende of alumina, magnesia, iron, and lime. Of the following analyses a. is a "tremolite" from Clicker Tor, analysed by the Rev. Wm. Gregor (Ann. Phil., 2, 1813, p. 154); b. is an "asbestos actinolite" from Huel Unity, analysed by Thomson, in which the iron is partly replaced by manganese; sp. gr. 2·91 (Ann. Phil. 1814):—

	a.	b.
Silica	62·2	33·40
Alumina	—	28·20
Oxide of iron	5·9	17·15
Oxide of manganese	trace	7·20
Lime	14·1	1·05
Magnesia	12·9	0·60
Soda	trace	3·80
Oxide of copper	—	1·00
Water	1·0	1·70
Loss	3·9	5·90
Total	100·0	100·00

The range of composition in foreign varieties is very great. In *Actinolite, Asbestos*, &c., the silica ranges from 55·0 to 60·0 per cent., alumina 0 to 3·2; oxide of iron 3·0 to 12·0, oxide of manganese 0 to 1·2; magnesia 9·5 to 24·0, lime 9·5 to 21·0, water 0 to 3·6. In *Tremolite*, silica 57·3 to 60·6, alumina 0 to 1 8, oxide of iron 0 to 2·4, magnesia 24·0 to 28·2, lime 11·0 to 15·1, water 0 to 3·3. *Hornblende*, silica 37·0 to 55·0, alumina 4·5 to 17·6 peroxide of iron 0 to 10·2, protoxide of iron 5·8 to 29·3, oxide of manganese 0 to 3·5, magnesia 5·0 to 21·0, lime 4·6 to 15·0, water 0 to 2·0.

With silica 57·6, magnesia 28·8, lime 13·6, the formula for Tremolite may be

$\dot{\dot{C}}a\ 3\dot{\dot{M}}g\ 4\dot{\dot{S}}i$ (oxygen ratio for bases and silica 1 to 2) or $Si_4O_4Mgo''_3Cao''$.

With silica 53·6, magnesia 18·0, oxide of iron 16·0, lime 12·5, the formula for Actinolite may be $\dot{\dot{C}}aFe2\dot{\dot{M}}g4\dot{\dot{S}}i$ (oxygen ratio = 1 to 2) or $Si_4O_4\ Mgo''_3Feo''Cao''$.

With silica 53·1 alumina 11·3, oxide of iron 15·9, magnesia 13·2, lime 6·5, the formula for Hornblende may be

$\dot{\dot{C}}a2Fe3\dot{\dot{M}}gAl_2\dot{\dot{S}}i$ (oxygen ratio for protoxides, peroxides, and silica = 6 : 3 : 16) or $Si_8O_7Al_2o''Mgo''_3Feo''_2Cao''$.

Obs. Tremolite usually occurs associated with limestones, particularly those that contain magnesia. Actinolite is associated sometimes with steatite; the asbestiform variety with serpentine; Hornblende with mica schist, chlorite schist, and gneiss.

Loc. 1. Hornblende—Botallack, Cape Cornwall, and many other parts of St. Just; Marazion Mines, Acton Castle, Cuddan Point, and many parts of the Mount's Bay coast; Goonhilly Downs, Mullion, Kynance, Coverack, Cadgwith, and other parts of the Lizard district; West Godolphin Mine, Breage; West Poldice Mine, St. Ives; Great Dowgas Mine, St. Stephens; Camborne Vean, Dolcoath, Huel Crofty, and other Camborne mines; Tresavean Mine; Penmare Point, Veryan; Five Lanes, Launceston.

Hay Tor, Brent Tor, Bovey Tracey, and other places in Devon; but seldom in well-formed crystals.

2. Actinolite—At most of the above localities, and at North Roskear Mine, Camborne; in greenstone, between East Huel Crofty and Pool; Trevascus Mine; St. Ives Consols, Huel Unity, Gwinear; the Consolidated Mines, Gwennap, at 320 fathoms from surface; Charlestown United Mines and Duforth Mine, St. Austell; Great Retallack Mine Perranzabuloe; Maudlin Mines; St. Cleer; Cheesewring and Clickor Tor, near Liskeard; Delabole Slate Quarries, in dark green foliated masses; Fowey Consols, in quartz.

Seaton, Sticklepath, near Okehampton, &c.

3. Tremolite—St. Just, Lizard, and St. Cleer; in the abovementioned localities; and at East Huel Crofty.

4. Asbestos, Amianthus, Mountain Wood, Mountain Paper, Mountain Leather, &c.—At most of the above localities; at St. Veep, of a dull white colour; and at Axmouth, Seaton, and Sidmouth, in Devon.

Foreign localities of all the varieties are very numerous.

Obs. Many of the "greenstones" of the West of Cornwall, especially about Gwinear and Marazion, consist of nearly pure hornblende, or of hornblende intimately mixed with felspar. Some of them contain minute grains of magnetite disseminated through them, which, if the rock be finely powdered, may be separated by the magnet. Like most of the ferruginous hornblendes, they are very liable to decomposition, thus forming some of the richest soils of the county.

Amphibole and Pyroxene are very closely-related species, if, indeed, they should not rather be viewed as one. Dana remarks that "it is impossible to distinguish them by blowpipe characters alone." The range of chemical composition is so great as to render a chemical division in the highest degree artificial. Crystals of amphibole and pyroxene differ

strikingly in habit and in modifications, but it is quite possible to refer all these modifications to the same system of axes. Twins have been found composed part of amphibole and part of pyroxene. The sp. gr. of hornblende is, however, usually a little less than that of pyroxene, and hornblende mostly occurs in rocks containing quartz or free silica, and orthoclase or albite, while pyroxene occurs in rocks containing little or no free silica, and with such minerals as labradorite, olivine, and leucite.

It seems not unlikely that hypersthene also might be included in one species with amphibole and pyroxene. Hypersthene is sometimes made to include bronzite, but Dana includes some infusible bronzites with amphibole, and the fusible varieties with augite.

Much of the so-called asbestos is chrysotile, or fibrous serpentine. It may be distinguished from the true asbestos by giving off a large quantity (12 to 14 per cent.) of water, on heating in a matrass.

Angles.

M M′ =	124°	30′	b r =	105°	46′
M O	103	12	r r′	148	50
M b	117	45			

Amygdaloid. A rock of a vesicular structure, the cavities being occupied with different materials. When these are light coloured, as is usually the case, and the rock is dark, the whole presents an appearance something like almonds in a cake. Hence the name, from a Greek word signifying an almond. Such rocks are common in the Hebrides, the Giant's Causeway, and in many volcanic regions. Many of them seem to have been originally vesicular lavas, through which water charged with calcareous and siliceous matter has percolated, and gradually filled up the cavities with agates, spars, zeolites, &c. Some of the cliffs near the Botallack Mine exhibit an imperfect amygdaloidal structure.

ANALCITE.

[Analcime. Kubizite.] Cubical, usually in deltohedrons, like Fig 5, but sometimes a combination of the cube and deltohedron (Fig. 19); also massive, fibrous, or radiating; brittle; imperfect conchoidal or uneven fracture; transparent to opaque; vitreous or pearly; white, or various shades of grey, green, yellow, red; streak white, H. 5 to 5·5; G. 2 to 2·3; feebly frictio-electric.

B., etc In matrass gives off water, and turns white; on C alone turns white, and fuses at 2·5 to a clear glass; readily decomposed by HCl, depositing gelatinous silica.

Comp. Analcite is an hydrated silicate of alumina and soda. Its range of composition is silica 51·0 to 56·2, alumina 22·2 to 24·2, lime 0 to 5·8, soda 6·5 to 14·6, potash 0 to 4·6, water 7·6 to 9·7. With silica 54·6, alumina 23·3, soda 14·1, water 8·2, the formula may be written $\dot{N}a_2\ddot{A}l_24\ddot{S}iH_2$ (oxygen ratio for protoxides, peroxides, silica, and water 1 : 3 : 8 : 2, or, counting the water basic 3 : 3 : 8), or $Si_4O_8Al_2o^{vi}Na_2o_3H_2o_3$.

Loc. It is said to have been found in cavities of the cliffs near Botallack, but the author has never seen a Cornish specimen; the mention of it may, however, lead to its discovery in this not unlikely locality. It is found in Scotland, Ireland, Faroe, Iceland, Norway, Germany, Italy, United States, &c.

Obs. Analcite is usually found in amygdaloids, or in rocks of volcanic origin, in forms resembling Figs. 5 and 19.

Angles.

a a =	90°	00′	n n =	146°	27′
a n	144	44	n n′	131	49

Analysis. The separation of the constituent parts of a compound. The statement of the result of the process is often spoken of as the analysis. The person by whom the work is done is called the analyst.

ANATASE.

[Octahedrite.] Pyramidal; in small crystals, like Figs. 72. 73, and 234, with perfect cleavages parallel to P. and O. from P. to P. = 97° 51′, P. to O. = 111° 42′; brittle; sub-conchoidal or uneven fracture; semitransparent to opaque; lustre adamantine or sub metallic, usually brilliant; brown to deep blue by reflected light, greenish-yellow by transmitted light; streak white or slightly coloured; H. 5·5-6; G. 3·8-4, after heating 4·1 to 4·16; frictio-electric.

B., etc. In matrass unchanged or phosphorescent; on C infusible; with soda melts to a dull yellow globule, white on cooling; with micro. OF forms a clear bead, which is yellow while hot, violet when cold; if iron is present the bead may be brownish, but will be rendered violet by the addition of a small fragment of tinfoil; soluble in concentrated H_2SO_4, but not in HCl or HNO_3.

Comp. Titanic anhydride. $\ddot{T}i$ or TiO_2; Oxygen 79·71, Titanium 60·29.

Loc. Looe Mills Hill Quarry, near Liskeard; Tintagel Cliffs; Delabole Slate Quarries; Virtuous Lady Mine, in chlorite, in crystals, like Figs. 72 and 73, which vary in size from one-sixth of an inch downwards to microscopic crystals.

Angles.

P P =	97°	51′	e e =	116°	43′
P P′	136	30	e e′	121	16
P O	111	42	l l	159	26
O v	160	15	c l	139	50

ANDALUSITE.

[Chiastolite. Macle.] Rhombic. Usually in four-sided prisms, like Figs. 94, and 95; also massive, with a lamellar structure; tough; fracture even or uneven; translucent to opaque; lustre vitreous or pearly, but often dull; white, or tinged with violet, grey, red, green, brown; streak white; H. 7-7·5, except when partially decomposed, when it may be as low as 3; G. 2·9-3·4.

Var. Chiastolite is a variety occurring in square prisms, which appear to be made up each of four crystals, having prisms of a darker colour in the centre and at each angle, connected by thin plates of the same, like Fig. 94. The colour of the dark portion may often be destroyed by heating.

B., etc. In matrass unchanged; on C infusible; the powder moistened with Co and again heated becomes blue; with borax fuses with difficulty to a transparent colourless glass; with soda swells up, but does not fuse; insoluble in acids, but some varieties are decomposed by HCl, leaving a mass of gelatinous silica.

Comp. Anhydrous silicate of alumina, but usually contains some peroxide of Fe and oxides of Mn, Mg, and Ca. The following range of composition has been indicated by various analyses of foreign specimens, viz.:—Silica 33·0 to 40·17; alumina 50·96 to 62·20; peroxide of iron 0 to 5·71; oxide of manganese 0 to 0·83; magnesia 0 to 1·14; lime 0 to 4·12; water 0 to 2·6. With silica 36·8, and alumina 63·2, its formula might be Al_2Si (in which case the oxygen ratio = 3 : 2) or $SiO(Al_2O_4)$".

Loc. "Andalusite, in attached and imbedded crystals, is said to occur on Dartmoor, and also in the neighbourhood of Okehampton. Chiastolite is found in small crystals penetrating an altered Devonian slate at Ivybridge, and also associated with axinite at Holestock, near Okehampton." (Report of Devon Assoc. 1868, p. 341.) Also Cumberland, Scotland, Ireland, Brittany, Spain, United States, &c.

Obs. Chiastolite may be distinguished from felspar by the black cross seen in the cross section of the crystal; andalusite by its superior hardness and extreme infusibility. The surfaces of the crystals are often rough, or covered with flakes of mica. In some instances the whole crystal has been converted into mica.

Angles.

M M =	90°	44′	M O =	90°	00′
O s	144	55			

Angle. See Crystallography.

ANGLESITE.

Rhombic, often in tabular or prismatic crystals, like Figs. 127, 128, 129, 130, 132, with cleavages parallel to M. and O., but not perfect; or drusy; also stalactitic or massive; brittle; fracture conchoidal; transparent, to translucent on edges only; adamantine, vitreous, or resinous; white, sometimes tinged grey, yellow, green, blue, brown; sometimes black on the surface; streak white; H. 3; G. 6·1-6·4.

B., etc. In matrass decrepitates and darkens; often yields a little water with acid reaction; on C fuses at 1·5 to a globule which is clear while hot, but milk white on cooling; in RF is easily reduced to a bead of Pb; with soda and silica gives the reaction for sulphur; almost insoluble in acids, but the powder is completely soluble in KHO.

Comp. Sulphate of lead, PbS, or $PbSO_4$, or SO_3Pbo".; oxide of lead 73·61; sulphuric anhydride 26·39.

Loc. Mellanoweth, near Hayle; formerly in gossan at Huel Maggot; Huel Bell, St. Erth; Huel Rose and Huel Penrose, near Helston; West Huel Chiverton; Pendogget, Liskeard; Beeralstone; East Tamar Mine; Beerferris, in geodes of decomposed galena, the faces M. and z. predominating. Fig. 132 is a Cornish form. Also Cumberland, Derbyshire, Anglesea, Scotland, Germany, Siberia, United States, &c.

Obs. Anglesite usually occurs with galena, pyromorphite, cerussite, and other ores of lead. It is not a common mineral in the West of England.

Angles.

O M =	90°	00′	d d′	78°	45′
O b	90	00	z z′	89	41
M M′	103	38	o o′	75	39
O o	127	45	L l	135	20
O d	140	38	d d	101	15

Anhydrous. Without water. Minerals which do not yield water, even when strongly heated, in a closed tube before the blowpipe, are said to be anhydrous.

Anhydrous Binoxide of Manganese. See Pyrolusite.

ANNABERGITE.

[Nickel green. Nickel ochre.] Oblique; in minute capillary crystals, as a flaky efflorescence; massive; disseminated; friable or sectile; dull or glimmering; various shades of green; streak light green

or white, shining; H. 2-2·5; G. 3-3·2.

B., etc. In matrass yields water and darkens; on C melts readily, giving off fumes with a strong garlic odour, and coating the charcoal white at a little distance from the assay; in RF yields a white brittle bead of metallic appearance; with borax OF a bead which is often violet while warm, and reddish-brown when cold; RF the bead becomes colourless or greyish; soluble in HCl or HNO_3, forming a green solution.

Comp. It is an hydrous arseniate of nickel. No analysis of a British specimen is known to the author. The average composition of foreign specimens analysed approaches to arsenic anhydride 38·6, oxide of nickel 37·2, water 24·2, which would agree with the following formula:—$3NiAs_2 + 8H_2$ or As_2O_2 $Ni''_3 + 8OH_2$.

Loc. Pengelley Mine and Huel Chance, St. Ewe; St. Austell Consols; Huel Jane, St. Kea, on kupfernickel (Niccolite). Also France, Germany, Canada, United States, &c.

Obs. From its occurrence on the surface of other nickel ores containing arsenic, it is probably a product of their decomposition.

Anorthic. See Crystallography.

Anthracite. See Coal.

Antimonial Ochre. See Cervantite and Stibiconite.

Antimonial Silver Blende. See Pyrargyrite.

Antimonial Sulphide of Iron. See Berthierite.

Antimoniate of Lead. See Bleinierite.

ANTIMONITE.

[Antimony Glance.] Rhombic; Fig. 97; usually in laterally aggregated prisms, with one perfect (brachydiagonal) cleavage; which truncates M M'; divergent or radiating; the cleavage planes often striated; also massive, with columnar structure; or fibrous, plumose, woolly, or felt-like; sometimes disseminated, brittle, or sectile; thin laminæ slightly flexible and malleable; fracture sub-conchoidal, but rarely obtained; opaque; metallic; steel-grey to lead-grey; streak black; H. 2; G. 4·5-4·7.

B., etc. In matrass gives a yellow or reddish sublimate but no water; on C fuses at 1, and burns with a greenish flame, depositing a white coating near the assay; entirely volatile, except sometimes a very little infusible slag, which gives Fe reactions; soluble in warm HCl, giving off H_2S; decomposed by HNO_3, leaving a white powder of oxide of antimony; decomposed by KHO, the solution yielding a yellowish flaky ppt. on adding HCl.

Comp. Anhydrous sulphide of antimony.

	a.	b.
Sulphur	74·0	74·06
Antimony	26·0	25·94
Total	100·0	100·00

a. by Bergmann, b. by Davy. Both specimens Cornish. With 72·88 per cent. of antimony and 27·12 of sulphur the formula will be Sb_2S_3.

Loc. Huel Boys, Endellion (Fig. 97), and plumose; Padstow and Tintagel, in N. and S. veins, in fibrous masses; Old Trewetha; Pendogget and Port Isaac (plumose), St. Merryn; Huel Lee, St. Minver; Pillaton, St. Stephens; Fowey Consols; Restronguet, near Devoran; Hennock; Bovey Tracey; Combemartin, in small quantities, with argentiferous galena, both fibrous and in acicular crystals. Also Cumberland, Scotland, France, Spain, Germany, Hungary, Italy, Borneo, N. America, S. America, &c.

Obs. It is the chief ore of antimony. It may be distinguished from jamesonite, which it often much resembles, by the absence of a basal cleavage, and its almost complete solubility in HCl; from pyrolusite, graphite, and molybdenite, by its fusibility. It is isomorphous with bismuthite.

Angles.

M M' =	89°	15′	M M =	90°	45′
M b	134	37	p′ p	109	16
M p	145	29	p b	125	22

ANTIMONY.

Hexagonal, sometimes in rhombohedrons, with perfect basal cleavage, like Fig. 221; sometimes striated, usually reniform, spherical, or massive; lamellar or granular; brittle; opaque; metallic; tin-white, with a greyish tarnish; streak like the colour; H. 3-3·5; G. 6·6-6·8.

B., etc. In matrass melts and gives a slight white sublimate when strongly heated; on C fuses readily and burns with a greenish flame, depositing a white coating on the charcoal near the assay, which tinges the flame greenish if directed upon it; sometimes a slight garlic odour; a melted bead crystallizes on cooling; may be entirely volatilized, except a very little infusible slag, which will give iron reactions; soluble in Aqua Regia.

Comp. Antimony, with usually a little iron, arsenic, silver, or other impurity. No analysis of a Cornish specimen is on record.

Loc. It is said to have been found in

the antimony mines near Padstow; also France, Germany, Sweden, Borneo, Canada, United States Mexico, Chili, &c.

Antimony. All minerals containing antimony when heated on charcoal deposit a white coating on the cool part of the support, no garlic odour being observable unless arsenic be present, which, however, is often the case. When lead, bismuth, cadmium, zinc, or silver are present the coating is liable to be obscured. In such cases there are no simple and *generally applicable* blowpipe tests.

Antimony Glance. See Antimonite.

APATITE.

Hexagonal; in six-sided prisms; often vertically striated and variously modified, like Figs. 189, 190, 191, 196; also massive, earthy, or fibrous; brittle; fracture conchoidal, uneven, or splintery; transparent to opaque; vitreous or resinous; brilliant to dull; white, or various shades of yellow, blue, green, brown, red; sometimes parti-coloured or dichroic; some crystals show a bluish opalescence when viewed in the direction of the principal axis; streak white; H. 4·5-5; G. 3·2-3·3; sometimes pyro or frictio-phosphoric.

Var. Francolite is a name which has been given to specimens occurring in small compound crystalline masses, sometimes greyish, greenish, or brownish; in minute white transparent crystals with curved faces, somewhat like Fig. 189, but with deep and uneven longitudinal striations; in thin plates with quartz and chalcopyrite, and in thin, hollow, pseudomorphous cubes of an inch or more, which, when first discovered are half full of a transparent fluid.

B., etc. In matrass unchanged; if mixed with micro. usually gives off HF; on C fuses at 4-4·5—some varieties infusible; with borax melts to a clear globule, which may be rendered opaque by "flaming;" soluble very freely in micro., affording a glass which is usually transparent while hot, but if saturated, opaque and crystalline on cooling; the powder moistened with H_2SO_4 and heated tinges the flame bluish-green; soluble in HCl or HNO_3 without effervescence; when warmed with H_2SO_4 gives off a gas (HF) which turns Brazil wood paper yellow if fluorine be present.

Comp. It is a phosphate of calcium, usually containing fluorine and chlorine. The variety called francolite contains only a trace of chlorine, as appears from the accompanying analyses. Foreign varieties of apatite contain from 0 to 4·1 per cent. of chlorine, and from 0 to 4·2 per cent. of fluorine.

Analyses; both by T. H. Henry, from Huel Franco (Francolite):—

	a.	b.
Phosphoric anhydride	41·34	41·80
Lime	53·38	52·81
Fluorine and loss	2·32	2·17
Chlorine	trace	trace
Oxides of iron and Manganese	2·96	3·22
Total	100·00	100·00

With phosphoric anhydride 42·2, lime 54·0, and fluorine 3·8, the formula for Fluorapatite (Francolite) may be written $9\dot{C}a_3P_2 + CaF_2$ or $P_3O_3Ca''_4CaFO$. With phosphoric anhydride 40·9, lime 52·3, and chlorine 6·8, the formula for Chlorapatite (Apatite) will be $9\dot{C}a_3P_2 + CaCl_2$ or $P_3O_3Ca''_4CaClO$.

The composition of a specimen lately analysed by Professor Maskelyne and Dr. Flight agreed with the following formula, viz., $5([3Ca_2PO_4]CaCo_3) + 2CaF_2$; or a fluorapatite, in which one part of the calcium phosphate is replaced by calcium carbonate. Its crystalline form differs somewhat from ordinary apatite.

Loc. The rocks north of Botallack, in white or yellowish-green crystals, with hornblende, axinite, magnetite, garnet, &c.; Botallack Mine; Huel Owles: St. Michael's Mount, like Fig. 196, with topaz, tourmaline, cassiterite, &c.; Godolphin Bridge Mine and Tremearne (with gilbertite), in brilliant and highly modified transparent bluish, greenish, or greyish crystals, in granite; Huel Kind, St. Agnes, on quartz, in small greenish crystals, with calcite, some like Fig, 189; St. Kea; Poldice, in hexagonal tables; Stenna Gwynn, greyish-blue in gilbertite; Fowey Consols and Huel Franco (Francolite); St. Stephens; Crinnis.

Bovey Heathfield; Chudleigh; near Bovey Tracey, cream coloured, in a quarry, Figs. 189 and 191. These crystals were sometimes two inches long, associated with pure tourmaline. This locality is exhausted, but other specimens may, perhaps, be found in the neighbourhood. Also Cumberland, Norway, Germany, Italy, United States, Scotland, Ireland.

Obs. Apatite is usually found in crystalline or schistose rocks, associated with tin and iron ores or with serpentine. In Cornwall and Devon it mostly occurs in granite, with tourmaline, cassiterite, and gilbertite.

Angles.

a a′	= 120°	00′	s o =	120°	36′
a b	150	00	x x	142	20
a o	90	00	r r	131	14
			u a	149	38
r o	124	20	r a	135	39
i o	157	05	u o	110	03
x o	139	47			

Aqua Regia. A mixture of HCl with HNO_3; so called because it will dissolve gold the "King" of metals.

ARAGONITE.

Rhombic, usually in acicular crystals, or hexagonal prisms (macles), with one distinct and two indistinct cleavages, forming angles of 121° 55′, 116° 10′, and 125° 47′; also in globular concretions; or reniform, dendritic, or coralloid aggregations; or drusy and investing; sometimes in fibrous or compact masses; brittle; fracture conchoidal or uneven; transparent to opaque; vitreous, resinous on fracture, silky if fibrous; white, or tinged with grey, yellow, red, blue, green, brown; streak white, or much lighter than the colour; H. 3·5-4; G. 2·7 to 3.

Var. Flosferri is the name given to coralloid varieties, satin spar to a fibrous variety.

B., etc. In matrass swells and falls to powder, evolving a very little water; on C infusible, but incandesces and becomes alkaline; when Sr is present, which is often the case, the flame will be tinged carmine red, especially after being moistened with HCl; if no Sr, then the flame will be brick red. Soluble with effervescence in dilute HCl or HNO_3.

Comp. It is an anhydrous calcic carbonate, but appears usually to contain a little Sr, Fe and H_2O as impurities. With carbonic anhydride 43·71, and lime 56·29, the formula will be $\dot{C}a\,\ddot{C}$ or $\dot{C}O\dot{C}ao$".

Loc. It is said to occur at Botallack and Huel Owles in white, grey, red, or bluish-green globular concretions, or incrustations, or druses, acicular and fibrous, on quartz and chalybite. Many of these are certainly calcite. Huel Edward, with chrysocolla; Levant, St. Erth, in fine macled hexagonal crystals, and in coralloid forms (flosferri); Huel Edward, Calstock; Mawnan cliffs, near Falmouth; Port Isaac and Tintagel cliffs, coralloidal, white, greyish, or pinkish; Buckfastleigh; Combemartin (flosferri); Ilfracombe and Torbay, in beautiful acicular crystals and fibrous masses, in thin veins traversing slate; also Cumberland and other parts of England, Scotland, Ireland, Spain, Germany, Hungary, Italy, United States, &c.

Obs. Aragonite is a little harder and a little heavier than calcite, which has the same composition, its cleavages are less distinct, and do not produce rhombohedrons as do those of calcite; it falls to pieces when heated in a matrass, in this also differing from calcite.

Arborescent. Branched like a tree. "Dendritic" is sometimes used in the same sense. Native Silver is often arborescent.

Arenaceous. Sandy.

Argentiferous. Containing silver.

ARGENTITE.

[Vitreous Silver. Silver Glance.] Cubic; in cubes, octahedrons, and rhombic dodecahedrons, or deltohedrons, more or less modified (Figs. 1, 2, 3, 5, 8, 19, 20, &c.); also reticulated, arborescent, stalactitic, amorphous, earthy, or disseminated; sectile, often somewhat flexible or malleable; fracture hackly, uneven, or earthy; opaque; lustre metallic, often dull; lead grey to black; sometimes iridescent; streak dark and shining; H. 2-2·5; G. 6·9-7·4.

Var. Black sulphuret of silver, silver mulm or silver black is an impure earthy variety.

B., etc. In matrass gives a yellowish sublimate of S; on C fuses at 1, and is easily reduced to a white malleable bead of Ag, giving off a sulphurous odour; insoluble in HCl; readily soluble, except a little sulphur, in hot concentrated HNO_3.

Comp. Anhydrous argentous sulphide, as appears from the analyses of foreign specimens, which yield from 77·6 to 85·3 per cent. of silver, with about 15 per cent. of sulphur, and usually some small proportion of Pb, Cu, and Fe. No analysis of a British specimen is published. With silver 87·05, and sulphur 12·95, the formula is Ag_2S or SAg_2.

Loc. Huel Herland, in well-defined crystals (Figs. 8 and 15) and massive; Huel Ann, Phillack; Huel St. Vincent; Huel Brothers; Huel Duchy (earthy); Huel Mexico; Huel Basset; South Huel Basset; North Dolcoath; Dolcoath; Mount Mine, Perranuthnoe, and some other mines in Cornwall, both massive and earthy. Also Scotland, France, Spain, Hungary, Italy, Germany, Norway, Siberia, Mexico, Peru, &c.

Angles.

o o =	109°	28′	n n =	146°	27′
a a	90	00	n n′	131	49
o a	125	16	a n	144	44
d d	120	00	a d	135	00

Argillaceous. Clayey.

Arragonite. Arragon Spar. See Aragonite.

ARSENIC.

[Native Arsenic.] Hexagonal; sometimes in rhombs with perfect basal cleavage, like Fig. 221, but usually reniform, stalactitic, mammillary, or reticulate; also massive; compact, with a curved amellar structure, granular, or disseminated; fracture uneven or fine granular; opaque; lustre metallic, often dull; whitish lead grey on fresh fracture, but usually a dark tarnish on the surface; streak grey; shining; H. 3·5; G. 5·9-6; when broken gives off an odour resembling that of garlic.

B., etc. In matrass a dark metallic sublimate when strongly heated; in open tube a white crystalline sublimate; on C volatilizes in dense white fumes without fusing, burning with a blue flame and strong alliaceous odour, and depositing a white coating on the cool part of the charcoal. It usually leaves a minute residue, which contains Fe, and sometimes Au, Ag, Co. Soluble in HCl.

Comp. Arsenic, with generally small portions of other metals. No analysis of a British specimen is recorded, but foreign specimens yield from 96 to 99 per cent. of As.

Loc. It is said to have been found at Dolcoath and Cook's Kitchen, with ores of tin and cobalt; also Norway, Germany, France, Siberia, Chili, United States, &c., generally in veins traversing altered slaty rocks.

Obs. Arsenic may always be detected in a mineral by the white crystalline sublimate which is formed when the assay is heated in an open tube, and the odour resembling garlic which is evolved when it is heated on charcoal in R F.

Arseniate. A compound of arsenic anhydride, with a metallic oxide; or arsenic acid in which the hydrogen has been replaced by a metal. Arsenic may be detected in arseniates, arsenides, or alloys, by the white incrustation deposited on charcoal far from the assay, and the strong alliaceous odour produced when this is treated with the reducing flame. The following arseniates occur in the two counties, each of which is described in its proper place:—

Olivenite,	*Pharmacosiderite,*
Liroconite,	*Pitticite,*
Clinoclase,	*Scorodite,*
Erinite,	*Annabergite,*
Cornwallite,	*Erythrite,*
Chenevixite,	*Bayldonite,*
Chalcophyllite,	*Mimetite.*

In many of these the arsenic is partially replaced by phosphorous. All are hydrous except mimetite.

Arseniate of Cobalt. See Erythrine.

Arseniate of Copper. See Olivenite, Clinoclase, Liroconite, Chalcophyllite, Cornwallite, Erinite, Chenevixite.

Arseniate of Iron. See Pharmacosiderite, Pitticite, and Scorodite.

Arseniate of Lead. See Mimetite.

Arsenic Bloom. Arsenic Oxide. See Arsenolite.

Arsenic Silver. "A mixture of mispickel and discrasite, found formerly at North Dolcoath in masses with a concentric lamellar structure, alternating with quartz, the whole bearing some resemblance to agate."

Arsenical Cobalt. See Smaltite and Cobaltite.

Arsenical Iron. Arsenical Mundic. Arsenical Pyrites. See Mispickel.

Arsenical Nickel. See Niccolite and Smaltite (Chloanthite).

Arsenide. A compound of arsenic with some other metal or metals. Arsenides differ from arseniates in the absence of oxygen. They are much like sulphides in their physical properties. The arsenides found in the two counties are *Niccolite, Smaltite, Cobaltite, Leucopyrite* (?). Mispickel is a sulpharsenide.

ARSENOLITE.

[Arsenious acid, Arsenious anhydride.] Cubical; sometimes in octahedrons with octahedral cleavage, but usually capillary, flaky, pulverulent, stalactitic, botryoidal, or investing; brittle; translucent to opaque; vitreous, adamantine, silky, or pearly; often dull; white, or reddish, yellowish, brownish; streak white; H. 1-1·5; G. 3·6-3·7; taste sweetish and astringent; highly poisonous.

B., etc. In matrass altogether volatile, forming a white crystalline sublimate; on C is partly reduced at first to a grey brittle metallic bead, which may be volatilized in dense white fumes by continuing the blast; gives a strong alliaceous odour; deposits a white coating at some distance from the assay; slightly soluble in water, more so if the water be warmed; soluble in HCl, the solution deposits a grey metallic coating on clean copper.

Comp. Arsenious anhydride. As_2O_3; it often contains a little sulphur. When pure its composition is—Arsenic 75·76, oxygen 24·24.

Loc. Huel Sparnon and some other mines, in acicular crystals, filling cavities in smaltite; sometimes investing smaltite and cobaltite. Also Germany, Transylvania, Spain, California, &c.

Asbestos. See Amphibole.

ASBOLANE.

[Earthy cobalt.] Amorphous; massive, earthy, pulverulent, or incrusting; sectile, almost malleable; opaque; resinous, glimmering, or dull; bluish and brownish-black; streak black, shining; H. ·5 to 1·5; G. 2 to 2·2.

B., etc. In matrass yields water; on C, infusible; with micro gives a deep blue bead in both flames; soluble in HNO_3, yielding a pink solution.

Comp. It appears to be a hydrated oxide of cobalt and manganese, but is very uncertain in its composition. No analysis of a British specimen is published, but two foreign specimens yielded 19·45 of Co O and 35·47 of Co_2O_3 respectively, there being in one case a larger and in the other as large a percentage of oxide of manganese, together with 20 per cent. of water. It should, perhaps, be regarded as simply a cobaltic variety of Wad.

Loc. Roscommon cliffs, St. Just; Huel Unity, Huel Gorland, and other mines in Gwennap, in soft bluish-black masses; also Cheshire, Scotland, Ireland, Germany, &c.

Asphaltum. See Bitumen.

Assay. "A trial of the quality of minerals;" a determination of the quantity of any element in a given compound; also the portion of substance tried.

Astringent. Anything having a taste which seems to dry up the juices of the palate and tongue is said to be astringent. Ex. Alum and copperas.

ATACAMITE.

Rhombic, with a perfect brachydiagonal cleavage; usually in aggregates of acicular prisms; or reniform, granular, massive, disseminated; structure often curved lamellar and radiating; brittle; fracture conchoidal or uneven; translucent to opaque; vitreous or silky; colour various shades of green, mostly dark; streak light green; H. 3 to 3·5; G. 4 to 4·3 (Botallackite 3·6).

Var. Botallackite (Church) is, perhaps, a variety of atacamite, it occurs in minute interlacing crystals on killas; it is vitreous, pale green, with a white streak. Tallingite may, perhaps, be another variety; its colour is blue, and it occurs in "thin crusts consisting of irregular aggregations of minute globules, which appear botryoidal under the microscope." It is, however, described under its own name.

B, etc. In matrass gives off water with an acid reaction; with a strong heat a greenish sublimate is deposited; on C colours the flame bright blue; with the R. F. it is easily reduced to a malleable bead of Cu; easily soluble in HCl or HNO_3 with little or no effervescence; readily soluble in ammonia, forming a deep blue solution.

Comp. It is a hydrated oxychloride of copper. The following analyses, by Professor A. H. Church, of specimens from Botallack, shew the composition of a Cornish specimen of atacamite (a), and another of botallackite (b); the analysis of tallingite (c) and another mineral examined by Professor Church (d) are subjoined for comparison:—

Oxide of	a.	b.	c.	d.
copper....	54·32	66·25	53·57	67·25
Copper	13·57	—	10·11	—
Chlorine ...	15·20	14·51	11·33	8·73
Water	16·91	22·60	24·99	26·56
Total.....	100·00	103·36	100·00	102·54

(a) agrees very well with the formula $3CuH_2O_2 + CuCl_2 + H_2O$; (b) with $3CuH_2O_2 + CuCl_2 + 3H_2O$; (c) with $4CuH_2O_2 + CuCl_2 + 4H_2O$; (d) with $6CuH_2O_2 + CuCl_2 + 6H_2O$.

Loc. Botallack, Atacamite in crusts and stalactitic tubes; Botallackite in interlacing crystals, which are translucent under the microscope, and Tallingite as thin crusts of very small blue globular masses; Atacamite occurs chiefly in Chili and Peru, but also in Germany, Africa, and South Australia; it occurs also as a volcanic product at Vesuvius and Etna. Atacamite, Botallackite, and Tallingite may be distinguished from malachite by their little or no effervescence with HCl, and from all the other British ores of copper by their ready solubility in strong ammonia.

Attle. Rubbish; the refuse of a mine. Attle heap—Mine burrow.

Augite. See Pyroxene.

Auriferous. Containing gold.

Augitic. Containing Augite.

AUTUNITE.

[Uranite; Calcareous Uran mica.] rhombic; but the brachy and macrodiagonal nearly equal; crystals, like Fig. 122, closely resembling those of Torbernite (Chalcolite) see Figs. 74 to 76 and 89; cleavage, basal, perfect; sectile; translucent; sub-adamantine, pearly on the cleavage; greenish-yellow; streak yellow; H. 1-2·5; G. 3-3·2.

B., etc. In matrass yields water and turns to a straw yellow; on C fuses at 2 to a black mass with a semicrystalline surface; with soda forms a yellow infusible slag; soluble in HNO_3, forming a yellow solution.

Comp. No analysis of a Cornish specimen has been published, but foreign specimens yield about 15·7 of phosphoric anhydride, 62·7 of oxide of uranium, 6·1 of oxide of calcium, and 15·5 of water. With these proportions the formula will be $\dot{2}\dot{U}_2\dot{P}_2 + \dot{C}a + 8\dot{H}_2$ (oxygen ratio for protoxides, peroxides, phosphoric anhydride, and water = 1 : 6 : 5 : 8).

Loc. South Huel Basset, in small bright yellow, nearly transparent, crystals; Tolcarne, pale yellow inclining to green, at 30 fathoms depth; Huel Edward, St. Just; Gunnislake; Stenna Gwynn; Lostwithiel. Also France, Germany, and the United States.

Obs. Autunite was formerly thought to be isomorphous with Torbernite, and both were classed together as Uranite, but there seems reason to believe that they are distinct in form as they differ in composition. Autunite is said to be optically biaxial, that is, to have two axes of double refraction, which is the case with *rhombic* minerals, but not with those that are *tetragonal*. Autunite may be distinguished from Torbernite by its yellow streak; yellow solution in HNO_3, and by not yielding a bead of Cu with soda before the blowpipe.

Angles.

M O =	90°	00′	M M =	90°	00′ nearly.
O 1	115	53	O u	109	32

AXINITE.

Doubly oblique; usually in very oblique and unsymmetrical prisms, with rough or striated faces; often so flat as to appear tabular, Figs. 184 to 187; sometimes massive, curved lamellar, or granular; brittle; fracture conchoidal or uneven; transparent to translucent on thin edges; vitreous and brilliant; trichroic; brownish, bluish, greyish; streak white; H. 6·5-7; G. 3 to 3·3; frictio-electric, pyro-electric.

B., etc. In matrass no change; on O fuses at 2 with intumescence to a dark green magnetic glass, which in the O F turns black; with borax or micro Fe and Mn reactions; the powdered mineral fused with soda on platinum foil yields a green mass; with fluor and monopotassic sulphate, boracic acid may be detected; insoluble in H Cl until after fusion, when it is readily decomposed, leaving a jelly of silica.

Comp. It is an anhydrous and very complex silicate and borate of alumina, iron, manganese, magnesia, and lime. No analysis of a British specimen is published, but foreign specimens contain quantities varying as follows:—Silica 41·5 to 45·0; alumina 13·5 to 19·0; peroxide of iron 7·3 to 12·3; manganic peroxide 1·2 to 10·0; lime 12·5 to 25·8; magnesia 0 to 2·2; boric anhydride 2·0 to 5·6. With silica 41·1, alumina 16·8, peroxides of iron and manganese 15·8, lime 21·3, boric anhydride 4·6, the formula may be written $12\dot{C}a\ 5\ddot{A}l_2\ 3\ddot{F}e_2\ 2\dot{B}_2\ 21\ddot{S}i$ (oxygen ratio for protoxides, peroxides, boric anhydride, and silica = 2 : 4 : 1 : 7), or SiO_4 (2-7ths Ca. 4-7ths Fe. Al. 1-7th B.)$_3$.

Loc. Rocks north of Botallack, Huel Cock, and Trewellard, in fine brilliant clove brown crystals, which have been obtained as much as 1½ inch across, like Figs. 184 and 186, and forming a compact mass, with garnet, schorl, &c.; Lamorna Cove, near Penzance; Boscawen cliffs, St. Burian, light greyish-violet; Carn Silver, Lamorran creek; Carharrack; Camborne Vean; Trevascus; St. Columb; Terrace-hill Quarry, Callington; Lostwithiel; Huel Friendship, near Okehampton; Sticklepath; Brent Tor. Also Norway, Sweden, France, Spain, Italy, Germany, Russia, United States.

Obs. Pseudomorphous crystals of chlorite of the exact form of the St. Just axinite have been found on Dartmoor and at St. Just. The Cornish crystals of axinite have the faces c. v. p. r. z. usually predominating; the faces y. and c. are said to be peculiar to the St. Just crystals.

Angles.

P c =	113°	15′	l u =	153°	25′
P l	151	03½	r c	85	40
P z	116	26	r y	85	35
P y	96	32	r s	143	38
P r	134	48	r v	93	14
P s	146	39	r w	114	30
P u	135	25	r x	139	12
P v	102	30	u s	152	01
P w	119	50	v y	139	09
P x	130	28	x y	126	25
w y	151	30	c y	156	20

Axis. Axes are imaginary lines, crossing a crystal in its centre, to which its faces may be conveniently referred. See Crystallography.

Azurite. See Chessylite.

B.

BABINGTONITE.

Anorthic; usually in small crystals, like Fig. 235; two perfect cleavages, parallel to O f t. Also fibrous or radiating; brittle, fracture imperfect or hackly; thin splinters or laminæ trans-

lucent; vitreous; blackish-green, or dichroic, green, and brown; streak white or greyish; H. 5-5·5; G. 3·3-3·5.

B., etc. In matrass unaltered, or sometimes decrepitates; occasionally a little water is evolved; after heating it gives an alkaline reaction on test papers, on C fuses at 3 to a brilliant brownish-black globule, which is sometimes magnetic; with borax forms a clear reddish-yellow glass, nearly colourless on cooling; in reducing flame becomes greenish; with micro. the same reactions, but a skeleton of silica is left in the bead; scarcely acted upon by acids; with soda and nitrate of potash on platinum foil the manganese reaction is readily obtained.

Comp. Anhydrous silicate of iron and lime. The following is a recent analysis of a specimen from Devonshire, by Professor Forbes, F.R.S.:—

Silica	49·12
Alumina	1·60
Peroxide of iron	9·78
Protoxide of iron	12·87
Oxide of manganese	1·25
Lime	20·87
Magnesia	3·67
Loss on ignition	0·73
	99·89

this is nearly equal to $12Si\,Fe_2\,3Fe\,6Ca$ or $6CaOSiO_2+3FeOSiO_2+Fe_2O_3SiO_2$ or $Si_9O_9Feo''_3Cao''_6Si_3O_3Fe_2O_{11}$.

Loc. In a railway cutting in Devonshire; also in the Shetland Isles, and in Norway.

Obs. It is, in appearance, much like hornblende. The Devonshire mineral was discovered in 1854, and was so abundant as to be worked as an ore of iron.

Angles.

M t	= 112°	30′	O t	= 88°	00′
O M	92	34	h g	90	40

Baryta. The oxide of the metal Barium is so called.

BARYTES.

[Barite. Heavy spar.] Rhombic; in tabular or prismatic crystals, like Figs. 130 to 135, which are all Cornish forms; single, aggregated, or drusy; four distinct cleavages; M. and O. perfect, a. and b. less perfect, the cleavages forming angles of 90° 0′, 78° 20′, and 101° 40′; also in foliated, columnar, radiated, fibrous, granular, compact, earthy, or stalactitic masses; sometimes a curved lamellar structure; brittle; fracture conchoidal, but not easily obtained; transparent to opaque; vitreous to resinous; colourless, or white, grey, yellow, blue, red, brown; streak white, or sometimes slightly coloured like the specimen in the earthy varieties; H. 3-3·5; G. 3-4·7.

Var. Hepatite is an impure earthy variety, emitting a fœtid odour by friction or percussion. Cawk is a dirty white, earthy, opaque, massive variety.

B., etc. In the matrass decrepitates; on C infusible, or fusible only on the thinnest edges (Dana says fusible at 3); when touched with HCl and again heated tinges the flame yellowish-green; with borax melts into a clear glass, which turns yellow or brown on cooling; with soda fuses to a clear pearly mass, and is absorbed into the charcoal; if a portion of the charcoal be then removed, moistened, and placed upon a polished surface of silver a black stain will be produced; insoluble in HCl or HNO_3.

Comp. Anhydrous sulphate of Barium; with baryta 65·63, and sulphuric anhydride 34·37, the formula will be BaS or $SO_2\,Bao''$. No analysis of a Cornish or Devon specimen is known to the author. Foreign specimens have sometimes a large portion of the baryta replaced by strontia.

Loc. The United Mines and Ale and Cakes, Gwennap, from the 170 fathom level, in semitransparent greenish-grey, yellowish, or brownish crystals, some like Fig. 137, which darken on long exposure to light; St. Austell; Herodsfoot, in fine crystals; Huel Mary Ann, Liskeard, in fine transparent colourless, or yellowish crystals, with pyrites and fluor (Figs. 133 and 136, and also the combination M O o d u); Trehane, radiated, with green fluor; Hennock; Restormel; Menheniot, yellowish and transparent, in a lead lode; Babbicombe Bay, on calcite; Torquay; Bridford, S. Devon; also Surrey, Derbyshire, Staffordshire, Cumberland, Scotland, Norway, France, Germany, United States, &c.

It is largely used as a paint; for giving a smooth surface to paper-hangings, &c.

Angles.

M M′	= 101°	40′	O o	= 127°	18′
M O	90	00	O d	141	09
M a	129	10	d d	102	17
O a	90	00	o o	74	36
O b	90	00	O z	115	42

u truncates the edge d a, η truncates the edge M b. M O o, M O o a, M O b o d, M O o d u, M O η z, M O η o z are all Cornish forms.

Basalt Jasper. See Porcelain Jasper.

Basaltine. An old name for hornblende.

Base. A compound of a metal and oxygen, which by union with an anhydride can form a salt. Thus in an analysis of 100 grains of carbonate of lime there would be obtained 56 grains of lime and 44 grains of carbonic anhydride. Here the 56 grains of lime would be called the base.

BAYLDONITE.

Amorphous; occurs in minute mammillary concretions, with a drusy surface; structure often somewhat reticulate; brittle; fracture sub-conchoidal or uneven; sub-translucent; lustre strongly resinous; grass-green to blackish-green; streak siskin to apple-green; H. 4·5; G. 5·35.

B., etc. In matrass gives off water and turns black; on C fuses at first to a black bead; deflagrates; gives off an alliaceous odour; leaves a hard white metallic bead of Pb and Cu; with borax gives Cu reactions; soluble in warm HNO_3, but not readily.

Comp. Hydrated arseniate of lead and copper. The following is the mean of three analyses of Cornish specimens, by Professor A. H. Church:—

Arsenic anhydride	31·76
Oxide of copper	30·88
Oxide of lead	30·13
Peroxide of iron, lime, and loss	2·65
Water	4·58
Total	100·00

With arsenic anhydride 31·6, oxide of copper 32·8, oxide of lead 30·7, water 4·9, the formula will be $\dot{A}s_2\dot{3}CuPb3H_2$ (oxygen ratio for $\dot{R}\,AsH_2 = 4.5.2$) or PbO, 2CuO, $As_2O_5 + CuH_2O_2 + H_2O$ or As_2O_2 Pbo"Cuo"$_2CuHo_2 + OH_2$.

Loc. Found lately in Cornwall, by Mr. Talling, of Lostwithiel, and described by Professor A. H. Church (Journal of the Chem. Soc., II. vol. iii., 265, 1865). It is often seen in old Cornish collections of minerals.

Obs. An arseniate of lead and copper, from Huel Alfred, in Phillack, was analysed by Mr. Michell, in the year 1825, which may have been impure Bayldonite. It was mammilated; granular; leek-green in colour. Its composition was PbO 31·5, CuO 28·0, As_2O_5 24·0, Fe_2O_3 2·0, SiO_2 10·0, H_2O 2·0.

Beekite. See Calcedony.

Bell Metal Ore. See Stannite.

BERAUNITE.

Obliqu; usually in foliated or radiated masses, with one distinct and one indistinct cleavage, at an angle of 90°; also columnar or investing; brittle; vitreous, pearly, or sub-metallic; red or reddish-brown; streak dirty yellow; H. 2; G. 2·8-2·9.

B., etc. In matrass gives off water and turns darker; on C alone fuses easily to a dark magnetic globule, colouring the flame bluish-green like Vivianite; with borax gives Fe reactions; soluble in HCl.

Comp It is a hydrous ferric phosphate. No analysis is published.

Loc. Huel Jane, near Truro, on Vivianite and Niccolite; also Bohemia, Crimea, &c.

Obs. It appears to be an altered Vivianite, from which it may be distinguished by the colour of its streak.

BERTHIERITE.

[Haidingerite.] Rhombic? Occurs in indistinct confusedly aggregated prisms; granular or plumose; several longitu- cleavages, more or less distinct; sometimes a lamellar structure; brittle; opaque; metallic, glimmering; dark steel-grey, iridescent, or spotted red or brown; streak dark grey or black; H. 2 to 3; G. 4 to 4·3.

B., etc. In matrass fuses and gives a faint yellow sublimate; with a strong heat forms a black sublimate, which is brownish-red on cooling; on C fuses and yields a dark magnetic slag, depositing a white coating on the charcoal and giving a sulphurous odour; with borax the slag gives Fe reactions; soluble in HCl, yielding an odour of sulphuretted hydrogen.

Comp. Sulphide of antimony and iron. No analysis of a Cornish specimen is on record. Foreign specimens yield from 28·0 to 31·3 per cent. of sulphur, 52·0 to 61·0 of antimony, 9·8 to 16·0 of iron, with sometimes a little zinc or manganese. With antimony 51·7, iron, 17·8, and sulphur 30·5 the formula may be $Fe_2Sb_4S_9$ or $3FeS + 2Sb_2S_3$; with antimony 60·0, iron 10·4, and sulphur 29·6 = $Fe_2Sb_8S_{15}$ or $3FeS + 4Sb_2S_3$; with antimony 57·0, iron 13·1, and sulphur 29·9 = $Fe_2Sb_6S_{12}$ or $3FeS\ 3Sb_2S_3$ or $FeSb_2S_4$ or $Sb_2S_2Fe_8$".

Loc. Near Tintagel; and near Padstow, in the antimony mines; also France, Germany, Hungary, United States, &c.

Obs. It has been worked as an ore, but yields antimony of an inferior quality. It is always associated with other ores of antimony. It may be distinguished from antimonite and jamesonite by the considerable quantity of magnetic slag left on charcoal after heating.

BERYL.

Hexagonal; usually in longitudinally striated prisms, like Figs. 188, 193, and 194, with an imperfect cleavage, parallel to O.; sometimes in columnar aggregates, or massive; brittle; fracture, sub-conchoidal or uneven; transparent to subtranslucent; vitreous or resinous; sometimes colourless, but more usually white, green, blue, red, yellow, grey, sometimes parti-coloured, iridescent, or opalescent; streak white; H. 7·5-8·0; G. 2·6-2·8.

Var. Emerald is a fine green variety, used in jewellery. The colour, in some varieties at least, seems to be due to a minute proportion of chromium. The emerald has not been found in Cornwall.

B., etc. In matrass unchanged, or altered in colour only; on C alone the same, sometimes fuses on thin edges; with borax forms a clear glass, often tinged green or yellow; on adding powdered fluor spar the bead remains clear while hot, but becomes opaque on cooling; not acted upon by acids.

Comp. Anhydrous silicate of Aluminium and Beryllium, with usually small portions of Cr. Fe. Ca. Mg. or Na.; the only mineral containing Beryllium found in the United Kingdom. Foreign specimens yield from 64·0 to 70·0 per cent. of silica, 14·0 to 21·0 of alumina, and 11·0 to 15·0 of berylla. With silica 66·8, alumina 19·1, and berylla 14·1, the composition will be $\dot{A}l_2 3Be6\dot{S}i$ (oxygen ratio for protoxide, peroxide, and silica = 1 . 1 . 4), or $Si_6O_6Al_2^{VI}Beo''_3$.

Loc. Huel Castle, St. Just, amorphous; St. Michael's Mount, in small bluish crystals with topaz and cassiterite; Mabe and Constantine, in the granite quarries, in well-defined dull white crystals, embedded in fine-grained granite; Lustleigh, Devon, in granite; also Scotland, Ireland, Norway, Sweden, Germany, France, Italy, Siberia, India, United States, &c.

Obs. Crystals of beryl are sometimes very large. A crystal of beryl from the United States was 4 feet 3 inches in length, 2 feet 8 inches wide, and 1 foot 10 inches thick. Beryl may be distinguished from quartz by its superior hardness and by the striation of its crystals, which is longitudinal instead of transverse; from topaz by the form of its crystals (hexagonal prisms in beryl, rhombic prisms in topaz), and the imperfection of its cleavage.

Bindheimite. See Bleinierite.

BISMITE.

[Bismuth Ochre. Oxide of Bismuth.] Cubical? massive and foliated; earthy, pulverulent, disseminate; friable or very brittle; fracture earthy or conchoidal; opaque; glimmering or dull; yellow, greyish, greenish; H. ·0 to 1·0; G. 4·3.

B., etc. In matrass turns darker and gives off some water; on C is readily reduced to a grey, brittle bead, depositing a brownish incrustation; soluble in HNO_3 often with a slight effervescence; the solution yields a white precipitate when much diluted with water.

Comp. Anhydrous oxide of bismuth, often with a little Fe and As, besides water absorbed from the atmosphere. No analysis of a British specimen is on record (unless the mineral called agnesite be the same, but impure). With bismuth 89·65, and oxygen 10·35, the formula would be $\dot{B}i_2$ or Bi_2O_3. A specimen from Germany yielded oxide of Bismuth 86·4 per cent., equal to bismuth 75·3, and oxygen 11·1, besides oxide of iron 5·1, carbonic anhydride 4·1, and water 3·4.

Loc. Botallack; Levant; Huel Herland; Cost all Lost, St. Roach, in granite; Restormel Iron mine, with quartz and native bismuth. The mineral called agnesite, which is probably an impure bismite, occurred at Huel Coates, St. Agnes; also Germany and Siberia.

Obs. It may be distinguished from the carbonate of bismuth by its very slight effervescence in HNO_3.

BISMUTH.

[Native Bismuth.] Hexagonal; in rhombohedrons, with an angle of 87° 40′ (Fig. 203); cleavage basal, very perfect forming an angle of 123° 36′ with the face of the rhombohedron; often macled, or dendritic; mossy, granular, compact, foliate, or disseminate; sectile or almost malleable; opaque; lustre metallic; reddish white, often an iridescent tarnish; streak grey and shining; H. 2·0-2·5; G. 9·6-9·8.

B., *etc.* In matrass melts and forms a yellowish sublimate; on C fuses at 1 and volatilizes, forming a brownish incrustation near the assay; sometimes yielding an alliaceous odour, and depositing a white coating at some distance from the assay, from the presence of arsenic; soluble in HNO_3; the solution yields an abundant white precipitate on the addition of much water.

Comp. Bismuth, with traces of arsenic, sulphur, or tellurium. No analysis of a British specimen is on record.

Loc. Botallack, in small crystals on jasper; Levant, St. Ives Consols, lamellar, very fine and pure; Gt. Dowgas; Dolcoath, in purple and green fluor;

Huel Herland; Huel Sparnon, in feathery masses, with erythrine and smaltite; Trugoe, near St. Columb; also Cumberland, Scotland, Norway, Sweden, France, Germany, Spain, United States, &c.

Obs. The bismuth of commerce is mostly obtained from native bismuth. Masses of bismuth of several pounds weight are *said* to have been found loose in the soil near Redruth. Cupreous bismuth is said to occur at Huel Buller, and arsenical bismuth at St. Just. Bismuth is usually associated with tin, cobalt, or silver ores. The usual miner's test for bismuth is to heat the ore on a shovel, when it melts into globules readily. A rude assay is often made by heating the ore, without fluxes, in a crucible, when the metal fuses, and from its high specific gravity sinks to the bottom.

Angles.

R R	=	87° 40′
R o		123 36

BISMUTHINITE.

[Bismuthine. Bismuth Glance.] Rhombic; in acicular prisms, like Figs. 98 and 99; deeply striated longitudinally, with perfect cleavages, at right angles to each other, and parallel to a. and o.; also in columnar aggregates; massive, with foliated, radiated, or fibrous structure; granular; compact; disseminate; brittle, or sectile; opaque; metallic; tin-white to lead-grey; often iridescent; streak grey, shining; H. 2·0-2·5; G. 6·4-6·6.

B., etc. In matrass gives a yellowish sublimate; on C fuses at 1, boils, coats the charcoal yellow, and gives off a sulphurous odour; tinges the flame blue; may be entirely volatilized in the O F; in R F yields a grey, somewhat brittle bead of Bi; decomposed by hot HNO_3, which dissolves the Bi and leaves the S; the solution diluted with a large quantity of water yields an abundant white precipitate.

Comp. Anhydrous sulphide of bismuth, often containing small quantities of Fe and Cu. The following are analyses of Cornish specimens:—

	a.	b.	c.
Bismuth ...	72·49	78·00	68·53
Iron	3·70	1·04	2·90
Copper.....	3·81	2·42	2·98
Sulphur ...	20·00	18·42	19·33
Silica	—	—	5·01
Totals...	100·00	99·88	98·75

a. and c. are by Warrington, b. is by Rammelsberg.

With bismuth 80·74, and sulphur 19·26 (Bi = 208), the formula will be Bi_2S_3.

Loc. Botallack; Huel Cock; Levant; Balleswidden; Dolcoath; East Pool, in quartz; Pednandrea, some of the prisms macled at one end and pointed at the other so as to bear some resemblance to a pin; Huel Herland; Huel Sparnon; Fowey Consols; Lanescot; St. Columb, in stream works, as water-worn pebbles, like stream tin; Huel Arthur, Calstock; George and Charlotte mines, with childrenite; Great Dowgas; Devon and Cornwall United Mines, Devon, in fine crystals; Ivy Tor mine, near Okehampton; also Norway, Sweden, Germany, &c.

Obs. It may be distinguished from all similar minerals which occur in Devon or Cornwall by the white precipitate which falls from its solution in HNO_3 on the addition of water. It usually occurs in veins or cavities ("vugs") in quartz, slate, or granite.

Fig. 98 is a prism; Fig. 99 a section of the same.

Angles.

M M	=	91° 00′
M a		134 30
b a		90 00

Bisulphuret of Copper. See Covelline.

Bisulphuret of Iron. See Pyrites and Marcasite.

Bitter Spar. See Dolomite.

BITUMEN.

Asphaltum. Mineral Pitch. Amorphous, brittle, sectile, or plastic; fracture conchoidal or hackly; opaque; lustre resinous, brilliant to glimmering; brownish-black or velvet-black; streak greyish; H. 0 to 2·0, G. 1-1·2; frictio-electric.

Var. 1. Naphtha includes the fluid varieties.

2. Petroleum. Rather thicker than common tar, but hardens by keeping; has a bituminous odour; is soluble in ether and alcohol, probably a mixture of naphtha and asphaltum.

3. Elaterite. Elastic and flexible, like caoutchouc.

4. Asphaltum. Solid; fracture conchoidal; almost entirely soluble in ether.

B., etc. All burn with a bright smoky flame. Asphaltum melts at about 100° C, and when burnt leaves a small quantity of incombustible ash.

Comp. All are hydro-carbons of very uncertain and variable composition. Asphaltum contains from 1·0 to 12·0 per cent. of oxygen and nitrogen.

Loc. Petroleum.—Huel Unity and Huel Jewell, Gwennap; Carharrack Mine, St. Day; North Treskerby, Redruth; Chudleigh, Devon.

Asphaltum.—Poldice Mine, coating

quartz; Carharrack; South Huel Towan; Cook's Kitchen; North Treskerby; Great Huel Crofty; North Roskear; also Derbyshire, and other parts of England; Scotland, Germany, Greece, West Indies, &c.

Obs. It is probable that the above minerals are distinct species, and not mere varieties.

Black Copper. See Melaconite.

Black Hematite. See Psilomelane.

Black Jack. See Blende.

Black Lead. See Graphite.

Black Sulphuret of Silver. See Argentite.

BLEINIERITE.

[Bindheimite.] Amorphous, reniform, stalactitic, spheroidal, investing; compact, with curved lamellar structure, or earthy; brittle; translucent to opaque; vitreous, resinous, or dull; yellow, sometimes white, grey, brown; streak like the colour, usually yellow; H. 2·0 to 4·0; G. 3·9 to 5·0.

B., etc. In matrass gives off water and becomes darker; on C fuses at 1 (?); is readily reduced to a grey, brittle globule of antimony and lead, coating the charcoal yellow near the assay, and white outside the yellow; sometimes a very slight garlic odour; with soda, after long blowing, yields a malleable bead of lead; soluble in HCl.

Comp. Hydrated Antimonate of Lead. The following are analyses of Cornish specimens:—

	a.	b.	c.	d.
Oxide of antimony ...	42·22	42·44	46·70	47·36
Oxide of lead	47·04	46·68	43·94	40·73
Oxide of iron	—	—	1·44	--
Lime	—	—	1·34	—
Oxide of arsenic	—	—	trace	—
Water.....	11·50	11·98	6·46	11·91
Totals ...	100·76	101·10	99·88	100·00

a. b. and c. were analysed by Heddle, d. by Percy. a. and b. were white, c. was brown. With antimonic oxide 42·2, oxide of lead 46·5, water 11·3, the formula may be written $\dot{P}b\dot{S}b_2\ddot{3}H_2$, or $Sb_2O_4Pb'' + 3OH_2$.

Loc. Trevinnick Mine, Endellion, in large yellow detached masses, near the surface; also on Jamesonite, with antimonite and other ores of antimony; also found in Norway and Siberia.

Obs. It appears to be a product of the decomposition of Jamesonite.

BLENDE.

[Sphalerite. Black Jack.] Cubical, in cubes, tetrahedrons, rhombic dodecahedrons, octahedrons, &c.; often macled (Figs. 1, 2, 3, 8, 10, 35, 37, 39, 42, 52, 56], with a highly perfect dodecahedral cleavage; also botryoidal, fibrous, massive, compact, plumose, radiated, lamellar, or granular; brittle; fracture conchoidal or uneven, but not often to be observed; semi-transparent to sub-translucent; lustre sub-metallic, adamantine, or resinous; yellow, brown, red, black, rarely green or white; streak white or light brown; H. 3.5-4; G. 3·9-4·2; some varieties pyro or frictio-electric.

Var. Cleiophane is a pure white variety; Marmatite and Christophite are dark brown or black, and contain 10·0 per cent (or more) of iron; Przibramite is a variety containing from 1·0 to 5·0 per cent. of cadmium. It is usually dark in colour, and often granular or fibrous.

B., etc. In matrass decrepitates, and sometimes changes colour, or yields a slight white or yellowish sublimate; on C infusible, or fusible only on thin edges; with borax or soda and a strong heat exhibits a light green incandescence, and deposits an abundant white incrustation, which when treated with Co becomes green; soluble in strong HCl or HNO_3, giving off H_2S.

Comp. Anhydrous sulphide of zinc. The following are analyses of Cornish specimens:—

	a.		b.
Zinc.....	58·64	...	43·00
Iron.....	11·96	...	22·50
Copper	—		0·80
Sulphur	28·64	...	31·50
Silica	0·76	...	—
Totals	100·00	...	97·80

a. is by Thomson, b. is from Huel Ann, analysed by Gregor. The sp. gr. of a. was 4·049, the colour was blackish-brown.

Foreign specimens yield from 44·6 to 66·3 of zinc, 0 to 18·2 of iron, 32·1 to 33·8 of sulphur. With sulphur 33, and zinc 67, the formula will be ZnS.

Loc. Botallack Mine; Goonhavern Mine, Newlyn; West Huel Darlington; St. Agnes, in fine crystals (Figs. 37, 39, &c.); Huel Sperries; Nangiles; Huel Vor; Huel Rose; Huel Penrose; Lanescot; Huel Brothers, Calstock; Par Consols; Huel Crofty; Huel Unity, white, mammillated, and fibrous; Fowey Consols, fibrous, white, and transparent (Cleiophane), and cadmiferous; Landkey, near Barnstaple; Beeralston; Tamar Mines; Hennock; Combemartin; Huel Betsy and Huel Friendship, Tavistock; and many other localities in Cornwall and Devon.

Obs. By oxidation it sometimes gets covered with a coating of Goslarite. Blende often accompanies ores of lead, tin, and copper, and is usually considered a good sign. Hence the expression, "Jack rides a good horse."

Angles.

a a =	90° 00′	o a =	125° 16′
d d	120 00	m a	154 46
o o	109 28	m o	150 30
o o′	70 32		

Blistered Copper Ore. See Chalcopyrite.

Bloodstone. See Calcedony (Heliotrope.)

Blowpipe. An instrument used for the purpose of directing the flame of a lamp or candle so as to concentrate its power. It is much used in testing minerals. The complete blowpipe or pyrognostic examination of a mineral consists of eight or more distinct operations, but some of these may usually be omitted with advantage. The operations are as follows:—

1st. Heating the assay in a small tube of hard glass, sealed at one end, and known as an "ignition tube," "closed tube," or "matrass." The matrass should be two or three inches long, and from one-eighth to one-quarter inch in diameter. It must be clean and dry. A spirit lamp is the best source of heat for this experiment, and the assay should be heated gradually, the better to see the changes produced; at the close of the operation the flame may be urged with the blowpipe if no change, or but little, has been already effected. The changes to be looked for are—

a., changes of colour;
b., decrepitation;
c., deposition of moisture, or a sublimate, on the cool part of the tube;
d., the evolution of a vapour or peculiar odour.

2nd. A fragment of the substance to be examined is placed in a tube about six inches long, open at both ends, the tube being held in an inclined position over the flame. As before, the flame may be urged by the blowpipe towards the close of the experiment. The effects to be noted are the same as in the first instance, but the sublimates will sometimes be different, and the odours more distinct.

3rd. A little of the coarsely-powdered assay is placed in a small cavity scooped on the surface of a piece of charcoal with a penknife. The flame of a candle or of an oil lamp is then directed upon the assay by means of the blowpipe, using the "oxidising flame" ("OF"). The effects to be observed are—

a., degree of fusibility;
b., evolution of vapour or odour;
c., deposition of an incrustation on the cool part of the charcoal support;
d., reduction to a bead of metal;
e., non-volatile residue;
f., tinging of the tip of the flame.

4th. If the non-volatile residue is white, a drop of a strong solution of Cobaltic nitrate ("Co") should be dropped upon it, and the mass again heated, noting the tint produced by this treatment.

5th. If the residue be any colour other than white it should be mixed with a little dry carbonate of soda ("soda") and heated strongly, using the "reducing flame" ("RF"). In some very obstinate cases a little borax or cyanide of potassium may be mixed with the soda with advantage. The result to be looked for is the production of a bead of metal. If the portions of reduced metal be very small they may escape observation; in this case the portion of charcoal round the assay should be cut out, ground up with water in a small mortar, and the light carbon and soluble soda washed away. Any shining particles of metal will then be easily detected.

6th. Make a small loop in the end of a piece of platinum wire, heat it in the flame of the spirit lamp, dip it into powdered borax, hold it again in the flame until the borax has melted into a clear glassy bead, add to it a very little of the powder of the substance to be tested heat it again, in the OF first, then RF if no distinct colour is produced, take a little more of the assay and repeat the operation, several times if necessary.

7th. Repeat the sixth experiment, using a bead of microcosmic salt ("micro.") instead of the borax.

8th. Hold a fragment of the substance under examination with a pair of platinum-pointed forceps, and direct the tip of the OF upon it. Observe any change of tint that may be produced in the flame, and also the degree of fusibility (see "Scale of Fusibility"), if the specimen be fusible.

In the absence of platinum forceps, a piece of platinum wire tightly twisted round the specimen will sometimes suffice. The eighth operation is of greatest use in the absence of such substances as give sublimates in the matrass or open tube, incrustations on charcoal, and coloured beads with micro. and borax (see

operations 1 to 7). When such results have been observed in the first seven operations the eighth should be omitted, or the platinum will be injured.

An assay piece the size of a mustard seed will generally be sufficient, and will be more manageable than a larger piece. For the detection of substances present in small quantity, however, it will be sometimes necessary to take a larger piece.

The results of each operation should be carefully compared with the blowpipe tables in the first part of the book.

Blue Copper. See Covelline and Chessylite.

Blue Iron Earth. See Vivianite.

Blue John. A Derbyshire name for Fluor.

Blue Lead. See Galena.

Blue Malachite. See Chessylite.

Bog Iron Ore. See Limonite.

Bog Manganese. See Wad.

Borate. A compound of Boric anhydride with a metallic oxide; or Boric acid in which the hydrogen has been replaced by a metal.

Borax. Borate of Soda. It is much used in the blowpipe examination of minerals.

Bornite. See Erubescite.

Botallackite. See Atacamite.

Botryoidal. Like a bunch of grapes. Malachite and Blistered Copper Ore are examples of botryoidal minerals. When the rounded prominences are larger and less distinctly separated, the mineral is mammillate; when the prominences are very irregular in size, and the larger ones themselves broken up by smaller prominences, the specimen is said to be reniform; when almost spherical, the term globular is used.

BOURNONITE.

[Endellionite.] Rhombic; usually in modified prisms, like Figs. 120 and 123, or macles, like Fig. 121; also massive, granular, compact, investing, or disseminate; brittle; fracture sub-conchoidal or uneven; opaque; lustre metallic, brilliant; steel grey to blackish-lead grey; streak the same; H. 2·5-3; G. 5·7-5·9.

Var. Wheel ore and cog-wheel ore are names applied to finely macled varieties, somewhat like Fig. 121.

B., etc. In matrass decrepitates and yields a dark red sublimate; in the open tube gives a sulphurous odour and a white sublimate of oxide of antimony; on C fuses at 1, and gives a white coating, and afterwards a yellow one nearer the assay; by alternately making use of the O F and R F a bead of Cu is produced, more readily on the addition of a little soda; decomposed by HNO_3, which forms a blue solution, and leaves a residue of sulphur, antimony, and lead.

Comp. Anhydrous sulphide of lead, copper, and antimony.

The following are analyses of Cornish specimens:—

	a.	b.	c.	d.
Antimony ...	24·23	28·50	26·30	25·00
Lead	42·62	39·00	40·80	41·00
Copper	12·80	13·50	12·70	13 00
Iron	1·20	1·00	—	1·00
Sulphur	17·00	16·00	20·30	20·00
Totals	97·85	98·00	100·10	100·00

a. was a specimen from Endellion, analysed by Hatchett; b. from Nansloe, by Klaproth; c. and d. were Cornish specimens, analysed by Field and Smithson.

With antimony 24·8, lead 42·4, copper 12·9, and sulphur 19·9, the formula will be $SbPbCuS_3$ or $Sb_2Pbs''_2$ (Cu_2S_2).

Loc. Huel Boys, Endellion (Figs. 120, 123), where it was first discovered by Count Bournon; St. Merryn, Padstow; Nansloe, Helston; Budock Vean, near Falmouth, crystallised, compact, and massive; Herodsfoot, in crystals, like Fig. 121, in simple crystals, like Fig. 120, filling hollow crystals of galena, accompanied with Barytes, Fahlerz, and hacked quartz, or massive; Beeralstone; also France, Germany, Italy, Mexico, Chili, Peru, &c.

Obs. It is usually associated with antimonite, jamesonite, galena, chalcopyrite, and chalybite.

Angles.

M M =	93°	40′	O o =	136°	17′
M b	136	50	O u	146	45
O a	90	00	O y	127	20
O b	90	00	a b	90	00
O n	138	06	e f	118	04
O x	154	27	e b	154	52

Bovey Coal. See Coal.

Brachydiagonal. The shorter lateral axis of crystals in the rhombic system is so called; also a cleavage plane parallel to this and the principal axes.

Brass Ore. An intimate mixture of Blende and Chalcopyrite, found at some mines in Cornwall.

BRAUNITE.

Tetragonal, the pyramid scarcely differing from Fig 1; often in macles of three; also massive, brittle; fracture uneven; opaque; lustre sub-metallic; colour dark brownish-black; streak the same; H. 6-6·5; G. 4·7 to 4·82.

B., etc. In matrass no change; on C infusible; with soda, borax, or micro.

gives Mn reactions; the powder soluble in warm HCl with evolution of Cl, sometimes a little gelatinous silica is left undissolved.

Comp. Anhydrous proto-peroxide of manganese with some silicate of manganese. No analysis of a British specimen is on record. Foreign specimens yield from 80 to 87 per cent. of protoxide of manganese, 8 to 10 per cent. of oxygen, and 8·0 per cent. of silica. With oxide of manganese 82·1, oxygen 9·3, and silica 8·6, the formula may be $4Mn_2 + Si\,O_2$ or $MnO + 3Mn_2O_3 + MnSiO_4$.

Loc. It is said to have been found in the manganese mines near Launceston; found in Piedmont, Germany, and Norway, Elba, India, &c.

Breccia. A mass of angular fragments of rock, cemented together by some other material.

Brick Red Copper Ore. See Cuprite (Tile Ore).

Bright White Cobalt. See Cobaltite.

Brittle. Easily broken. On attempting to cut a brittle mineral the fragments usually fly in powder from the edge of the knife with some considerable degree of force.

BROCHANTITE.

[Warringtonite.] Rhombic; in tabular or short prismatic crystals, vertically striated, and in appearance somewhat like Fig. 189, but shorter; cleavage perfect, parallel to O; also in acicular groups or drusy crusts; or massive, reniform, columnar; brittle; fracture conchoidal; transparent to translucent; lustre vitreous, pearly on cleavage plane; emerald green to blackish-green; streak bright green; H. 3 to 4; G. 3·7 to 3·9.

Var. Brochantite, crystals vertically striated; H. 3·5-4; G. 3·78-3 9. Warringtonite occurs in non-striated crystals, in form like a doubly curving wedge; paler green than ordinary brochantite; H. 3-3·5; G. 3·39-3·47. Woodwardite may also belong here, but is described under Langite.

B., etc. In matrass yields water with an acid reaction and turns black; on C fuses and yields a bead of Cu, with soda gives the reaction for sulphuric acid; insoluble in water, soluble in HCl, the solution yields an abundant white precipitate with solution of Ba Cl.

Comp. Hydrated cupric sulphate. The following are recent analyses of Cornish specimens:—

	a.	b.	c.
Sulphuric anhydride	17·2	18·93	16·73
Oxide of copper	68·8	68·27	68·24
Oxides of iron and zinc	1·0	—	—
Lime	0 8	—	—
Water	13·2	12·22	14·64
Insoluble matter	—	0·58	—
Totals	101·0	100·00	99·61

a. is by Pisani, b. by Warrington, c. by Maskelyne.

With sulphuric anhydride 19·9, oxide of copper 69·0, and water 11·1, the formula may be $\dot{7}Cu\,\dot{2}S\,5H_2$ or $S_2O_4Cuo''_2 + 5CuHo_2$.

Loc. Several specimens, both of Brochantite and Warringtonite, have been found in Cornwall; it also occurs in Cumberland, Germany, Ural, Mexico, Chili, &c.

Bronzite. See Diallage.

BROOKITE.

Rhombic; crystals usually more or less tabular, like Fig. 147, and striated, dull, or uneven; cleavage macrodiagonal, sometimes distinct; brittle; fracture conchoidal or uneven; translucent to opaque; lustre adamantine or sub-metallic; reddish or yellowish-brown; streak yellow or white; H. 5·5-6; G. 4 to 4·2.

B., etc. In matrass unchanged; on C infusible; with micro. a brownish-yellow glass, &c., like anatase; insoluble in HCl or HNO_3. If the powdered mineral be fused with potash on Pt foil, dissolved in HCl, and the solution boiled with metallic tin, it becomes violet, and red on dilution with water.

Comp. Titanic anhydride, $\dot{T}i$ or $\dot{T}iO_2$, like anatase and rutile No analysis of a British specimen is on record. Foreign specimens contain from 94 to 99 per cent. of $\dot{T}iO_2$, the rest being peroxide of iron, alumina, or water.

Loc. Virtuous Lady Mine, in microscopic crystals, embedded in chalybite, with chlorite and anatase; also Wales, France, Switzerland, Sicily, United States, &c.

Obs. Titanic anhydride is trimorphous, being pyramidal in anatase and rutile, but with different parameters; and rhombic in brookite. The face b is usually striated parallel to its intersection with M.

Angles.

M M′ =	80° 10′	b θ =	104° 06′
M b	139 55	b e	112 12

Brown Hematite ; Brown Iron Ore ; Brown Ochre. See Limonite.

Brown Lead Ore. See Pyromorphite.

Brown Spar. See Dolomite.

Buntkupferz. See Erubescite.

C.

Cairngorm. See Quartz.

CALAMINE.

[Smithsonite (Dana).] Hexagonal; in obtuse rhombohedrons, often curved; sometimes tabular; perfect rhombohedral cleavage; crystals usually indistinct; often compact, with the appearance of chalcedony; reniform, botryoidal, fibrous, stalactitic, investing; cellular, granular, earthy, friable; brittle; fracture conchoidal or uneven; transparent to opaque; vitreous, pearly, or dull; colourless, but more frequently white, or various shades of green, yellow, grey, or brown; streak white or slightly coloured; H. 5; G. 4·4·5.

B., etc. In matrass sometimes decrepitates and loses colour; on C infusible; moistened with Co and again heated turns green on cooling; with soda yields an abundant white coating of oxide of zinc, which becomes green when treated with Co; when cadmium is present a brown coating is also formed; soluble with effervescence in HCl.

Comp. Anhydrous carbonate of zinc. No analysis of a specimen from Cornwall or Devonshire has been made, but a specimen from Somersetshire yielded — Oxide of zinc 64·8, carbonic anhydride 35·2, which agrees exactly with the formulæ $\dot{Z}n\ddot{C}$ or $ZnCO_3$ or $COZno''$. Some foreign varieties contain as much as 53·0 per cent. of carbonate of iron, or 15·0 per cent. of carbonate of manganese.

Loc. Huel Mary, Lelant; Fowey Consols; Great St. George Mine; also Somersetshire, Derbyshire, Cumberland, Wales, Scotland, Ireland, Belgium, France, Spain, Italy, Germany, Hungary, Siberia, United States, &c.

Obs. It commonly occurs in limestone rocks, associated with galena and blende.

Calcareous Iron Ore. See Chalybite.

Calcareous Spar. See Calcite.

Calcareous Uran Mica. See Autunite.

CALCEDONY.

Calcedonic Quartz; amorphous; botryoidal, stalactitic, nodular, concretionary, or lining cavities in quartz or other rocks; brittle; fracture flat conchoidal or splintery; semi-transparent to opaque; resinous or waxy; shining, glimmering; white, grey, yellow, red, brown, green, blue, black; often clouded, striped, or mottled; streak white; H. 6·6·5; G. 2·6

Var. 1. Calcedony proper; usually stalactitic or botryoidal; often very delicate tints.

2. Carnelian; reddish or brownish, pale or deep in tint.

3. Chrysoprase; apple-green; the colour due to oxide of nickel, from 0·4 to 1·0 per cent.

4. Prase; translucent and dull leek-green. The name is also applied to hyaline quartz when of the same tint.

5. Plasma; sub-translucent; bright green, sometimes dotted with white.

6. Heliotrope or bloodstone is the same, dotted with red. The green is often duller in heliotrope.

7. Agate is a variegated calcedony; the colours in bands or clouds.

8. Moss-agate or Mocha-stone, the same, but the markings are dendritic or moss-like.

9. Onyx is a banded agate, the bands even and distinctly separated. In fortification agate the bands are in angular lines, something like the ground plan of a fortification.

10. Sardonyx is the same, but some of the layers are like carnelian.

11. Agate Jasper is a jasper with veinings or markings of calcedony.

12. Siliceous sinter is an irregularly cellular calcedonic quartz deposited from waters holding silicates in solution.

13. Flint is like Calcedony, but nearly opaque, and of duller tints; usually grey, smoky-brown; or brownish-black; the exterior is usually white, from a thin coating of silicate of lime; lustre glimmering; fracture deep conchoidal. Thin splinters often exhibit organic markings when viewed by transmitted light.

14. Hornstone, like flint, but more brittle, and the fracture splintery.

15. Basanite, Lydian Stone, Touchstone; velvet-black; compact, and the fracture not splintery. It is often slightly laminated.

16. Jasper. It is opaque; yellow, red, brown, dirty-green, greyish-blue, brownish-black; striped; the colour is generally due to oxide of iron. It is usually accounted a separate sub-species, and is described as such.

17. Beekite is a calcedonic pseudomorph, after various species of coral. It often contains some of the original carbonate of lime.

B., etc. In matrass sometimes changes colour, and usually yields a little water; on C alone infusible; with soda dissolves

readily with effervescence to a clear glass, of a colour like that of the assay; soluble in borax, with generally a Fe reaction; insoluble in micro.; insoluble in acids; slightly soluble in KHO. After strong heating has a sp. gr. of 2·2.

Comp. Silicic anhydride or silica, SiO_2, like hyaline quartz usually contains some oxide of iron, nickel, or manganese, and a little water. A grey calcedony from Hungary afforded—Silica 98·97, peroxide of iron 0·53, carbonate of lime 0·62. A clear red carnelian yielded 0·5 of peroxide of iron. An apple-green chrysoprase from Silesia yielded 1·0 per cent of oxide of nickel.

Loc. a. Calcedony.—Trevascus Mine, Gwinear; Ponsanooth, in greenstone; North Pool and Pednandrea, with cassiterite, very beautiful specimens, white, pale yellow, grey, brown, blue, black, some with a pearly grey enamel or incrustation; Dolcoath; East Pool; Botallack; Boscaswell; Balleswidden, and most of the St. Just mines; Goonhilly Downs; Lanescot; Huel Maudlin; Beeralstone; Haytor; near Sidmouth; near Beer; Blackdown-hills; Torquay; Broadhembury and Whitstone Pits, pseudomorphous after coral (Beekite); in rhomboids and six-sided plates, pseudo. after calcite and dolomite, at St. Just and North Roskear; in tabular crystals, pseudo. after barytes, in fine specimens at Herodsfoot and Huel Mary; after calcite and datholite at Haytor (Haytorite) and North Roskear.

b. Flint. Orleigh Court, near Bideford, with chert, green earth, and hematite forming a breccia; Dunscombe-hill, near Sidmouth, Blackdown-hills, and other localities in Devonshire, not rolled; Branscomb cliff; White cliff, near Chard; Buckland Brewers; Haldon; Tregoninghill and Trewavas, chipped; Vorlas, Ludgvan; Marazion beach; Looe Bar, Portreath, and most of the beaches of Cornwall, and the Scilly Isles.

c. Agate. Carn Brea-hill, south-east side; Huel Sparnon, Looe Bar, and near Gweek (fortification); Budleigh Salterton, in a bed of rolled pebbles; Haytor; Mary Church, Kynance, &c.

d. Prase. North Roskear, in white quartz; Garras Mine, near Truro.

e. Carnelian. Blackdown-hills, Devon.

f. Hornstone.—East Tamar; Beeralstone, pseudomorphous after fluor; Penmare Point; Herodsfoot; Orleigh Court; White cliff; Branscomb cliff; Haldon.

CALCITE.

[Calc Spar.] Hexagonal; in rhombohedrons, three and six-sided prisms, with trihedral summits; in scalenohedrons; in hexagonal plates, lens-shaped crystals, &c., see Figs. 188, 195, 197, 200, 201, 217, 218, 222, 223, 226, 227, all of which, with many others, have been observed in Cornwall or Devon; with three highly perfect cleavages, forming angles of 105·5; also massive, compact, granular, or lamellar; stalactitic, coralloid, fibrous, nodular, &c., or pseudomorphous after aragonite, gypsum, felspar, and other minerals; brittle; fracture conchoidal, granular, or earthy; transparent to opaque; lustre vitreous to pearly, brilliant to dull; colourless, or white, grey, yellow, pink, red, green, blue, brown, black, particoloured; streak white, or slightly tinged like the colour; H. 2·5-3; G. 2·5-2·8. strongly doubly refractive when transparent.

Var. 1. A pure transparent variety, with very perfect rhombohedral cleavage is called Iceland spar or doubly refracting spar.

2. A variety composed of small scalenohedrons projecting from a mass is called dog-tooth spar.

3. Satin spar is a fine fibrous variety.

4. Schiefer spar is lamellar, friable, and tender; by some supposed to be pseudomorphous after selenite.

5. Marble is massive and granular.

6. Limestone is massive and compact.

7. Stalactite and Stalagmite are varieties formed by deposits from water containing lime in solution.

8. Oolite is composed of small rounded concretions.

9. Pisolite, of larger concretions.

10. Swinestone is a variety which emits a fœtid odour when broken.

11. Chalk is an earthy variety, made up of fragments of minute shells, sponges, &c.

Many other varieties have received distinct names.

B., etc. In matrass decrepitates, loses colour, or remains unchanged; on C infusible, but becomes alkaline, glows, colours the flame brick red, especially after being moistened with HCl; with soda fuses to a clear mass at first, but finally the soda sinks into the charcoal and leaves a white infusible mass; soluble in borax with effervescence, the bead if saturated becomes white and opaque on cooling, freely soluble even in lumps with brisk effervescence in dilute HCl.

Comp. Anhydrous carbonate of calcium, but often containing a considerable percentage of the carbonates of iron, magnesia, or manganese. No analysis

of a specimen from Cornwall or Devon is known to the author. With lime 56·0, and carbonic anhydride 44·0, the formula

will be $\dot{C}a\ddot{C}$ or $Ca\,CO_3$ or COCao".

Loc. a. Calcite. Botallack, Huel Owles, and other St. Just mines, in pale pink crystals, like Figs. 200 and 223, and other forms; Huel Towan; Huel Penrose, near Helston, in pink masses; Binner Down; Cadgwith, in large plates and thick veins; Kynance, Lizard Point, and other parts of the Lizard district, often in veins; West Huel Grambler, dog-tooth spar in masses of quartz and compact fluor, and in skeleton crystals; Huel Buller; North Roskear; Polgooth; Garras; Huel Mary Ann, Menheniot; Huel Alfred; Tintagel, Boscastle, and Delabole; Beeralstone and Beerferris, in beautiful pale lilac rhombohedrons; Huel Friendship; Babbicombe Bay; Combemartin; Teignmouth and Torquay, and many other localities; in fissures on the coast; many mines near Liskeard, in fine crystals; in quarries near Beerhead (Beerstone), with green earth, crystals with brilliant facets, also massive and compact; at Exeter, in an amygdaloidal rock; Plymouth, in very fine scalenohedrons and other crystals, like Fig. 222, in cavities in the limestone rocks; and many other localities in the two counties.

b. Schiefer Spar. Plymouth, Delabole, Tintagel, with quartz and albite; Polgooth; North Roskear; Botallack; Beeralstone; also Derbyshire, Cumberland, and many other parts of England; Wales, Scotland, Ireland, and most other countries.

Obs. Calcite may be distinguished from aragonite by its crystalline form, cleavage, inferior hardness, and sp. gr., and by its not falling to pieces when heated in a matrass. Low hexagonal prisms, lens-shaped crystals, and tabular forms are said to prevail in Devon and Cornwall. Some of the masses of the pure transparent variety from Iceland (Iceland Spar) are very large. A single cleavage rhombohedron has been observed, more than six yards in length and three yards high (Dana, Syst. Min., 1868, p. 679). Chalk, marble, limestone, and oolite are rather rocks than minerals. Calcite passes into dolomite from the presence of $MgCO_3$, chalybite through $FeCO_3$, calamine through $ZnCO_3$. Above 75 different faces have been described, including 41 distinct rhombohedrons, 85 scalenohedrons, and seven hexagonal pyramids.

Angles.

R R =	105°	50′	o o =	90°	00′
o o′	120	00	o g	116	15
g g	134	57	r r	144	20

Cann. See Fluor.

Capillary. Hairlike, in fine fibres, like "acicular," but not straight.

Capillary Pyrites. See Millerite.

Capillary Red Oxide of Copper. See Cuprite (Chalcotrichite).

Carbonate. A compound of a metallic oxide with carbonic anhydride, or carbonic acid in which the hydrogen is displaced by a metal. The mineral carbonates have a hardness not exceeding 5, so that they will not strike fire with steel, nor scratch glass. The anhydrous carbonates crystallize in the hexagonal system, and cleave into rhombs with an angle of 105° or nearly; rhombic with prisms of 120° and 60°; or oblique with prisms of 105° and 75°. The lustre is vitreous or pearly, colours very varied. They are the typical spars. The hydrous carbonates vary much in crystallization. All the mineral carbonates when powdered effervesce in strong and warm HCl. Some effervesce briskly even in a lump with dilute and cold HCl. The carbonates found in the two counties are :—

Calcite,	*Cerussite,*
Dolomite,	*Cromfordite,*
Chalybite,	*Diallogite,*
Calamine,	*Malachite,*
Aragonite,	*Chessylite.*

The first eight are anhydrous, the last two are hydrous.

Carbonate of Copper. See Malachite and Chessylite.

Carbonate of Iron. See Chalybite.

Carbonate of Lead. See Cerussite.

Carbonate of Lime. See Calcite and Aragonite.

Carbonate of Lime and Magnesia. See Dolomite.

Carbonate of Manganese. See Diallogite.

Carbonate of Zinc. See Calamine.

Carnelian. See Chalcedony.

CASSITERITE.

[Oxide of Tin. Tin-stone.] Pyramidal, like Figs. 61 to 71 and Fig. 77; crystals often imperfect and usually macled, with some faces striated, rough, or uneven; also in rolled fragments, or botryoidal with radiated concentric structure; massive, disseminated; pseudomorphous after felspar, &c.; brittle; fracture uneven or granular; semi-transparent to opaque; lustre resinous; sub-metallic or adamantine; sometimes colourless, but usually grey, yellow, brown, or black; streak light

brown or greyish-white; H. 6-7; G. 6·8-7; some varieties with much iron 6·45.

Var. 1. Diamond-tin is a miner's term for crystals when of considerable size;

2. Sparable-tin occurs in small acute pyramids, almost acicular, like Figs. 65. 66.

3. Rosin-tin is reddish or yellowish, and semi-transparent.

4. Wood-tin or Fibrous-tin has a concentric fibrous structure, colour various alternating shades of brown.

5. Toad's Eye Tin is a variety of wood tin, occurring in small spherical masses embedded in tin of a darker or lighter tint.

6. Stream-tin is found in rounded masses, as if waterworn, in many of the river gravels of Cornwall and Devon.

7. Mine-tin is that which occurs disseminated through, or in veins traversing, granite or clay slate.

B., etc. In matrass unchanged, or decrepitates only; on C the same, loses colour, or is reduced where it touches the charcoal; with soda and KCy is readily reduced to a white malleable bead of Sn in R F; insoluble in HCl, HNO_3, or Aqua Regia.

Comp. Anhydrous stannic oxide, with sometimes as much as 10 per cent. of the oxides of iron or manganese.

The following are analyses of Cornish specimens:—

	a.	b.	c.	d.
Oxide of tin ...	98·93	96·26	91·0	94·5
Peroxide of iron & manganese	0·32	3·40	9·0	1·5
Silica	0·75	0·75	—	1·0
Alumina	—	—	—	3·0
Totals ...	100·00	100·41	100·0	100·0

a. was a specimen from Altarnun, analysed by Klaproth; b. was analysed by Thomson, c. by Vauquelin (the sp. gr. was 6·45), and d. by Johns.

With tin 78·67 and oxygen 21·33 the formula will be Sn or SnO_2.

The following percentages of metallic tin were obtained by means of a charcoal crucible and blast furnace, by Klaproth, viz.:—

Light brown acicular crystals	75 per cent.
Grey crystals from St. Agnes	74 do.
Wood-tin.....	73 do.
Stream-tin from Ladock	76 do.
Stream-tin from Altarnun	76 do.

From which it appears that the stream-tin is even more pure than the grey or light brown *crystals* from the mines.

Loc. a. Fine crystals have been obtained from Botallack, Huel Owles, and other St. Just mines (Fig. 65); the cliffs north of St. Just; Wherry Mine, near Penzance, in the cavities of a chloritic conglomerate, cemented with amorphous cassiterite; St. Michael's Mount, in the joints of the granite, with schorl, fluor, wolfram, and occasionally topaz, garnet, and beryl; Huel Providence and other mines near St. Ives and Lelant; Great Work, Huel Vor, Huel Metal, Great Huel Fortune, and other mines in Breage; East Huel Lovell, Trumpet Consols, and other Wendron mines; Huel Tremayne, and other Gwinear mines, in large macles (Figs. 69 and 70); Dolcoath, and other Camborne mines (Figs. 65, 66); Relistian (Fig. 62); East Pool; Huel Uny; Pednandrea (Figs. 61, 62, and other forms, sometimes associated with chalcedony); the United and other mines in Gwennap; Trevaunance, Polberrow Consols, Huel Towan, Huel Pye, Pell Mine (Figs. 61, 62), Huel Kitty, and most of the St. Agnes mines; Cligga Head; Beam Mine, Polgooth, Stenna Gwynn, Goonbarrow, Minear Downs, and other mines near St. Austell; Burthy Mine, St. Enoder, in small black crystals (Fig. 61) with native copper; Huel Maudlin (Fig. 62), Kit Hill, Callington, in fine black crystals; Drakewalls; Ashburton; Birch Tor; Yeoland Consols; Buckland Monachorum; Huel Sidney, Plympton; Rix Hill, near Tavistock; Chagford in granite at the Morley clay works; Plympton; in the granite of Dartmoor; as well as other places in Devonshire.

b. Sparable-tin (Figs. 65, 66) has been found in fine crystals at Dolcoath; Huel Uny; Pednandrea; Huel Park, St. Agnes; Huel Owles, St. Just; and many other mines; in the granite of St. Michael's Mount, &c.

c. Wood-tin has occurred at Polberrow Consols; Sancreed, in thick mammillary concretions capping quartz; Huel Garth, near Penzance; Great Huel Vor, Breage; and many of the Cornish stream works.

d. Toad's Eye Tin has been found in large masses at Tregurthy Moor and Gavriggan, embedded in quartz.

e. Stream-tin has been found in Carnon and other branches of Falmouth Harbour, in large quantities; also at Gwennap; Trewarda, Kenwyn; Ladock; Altarnun; Luxulian; Lanlivery; Fore Moors, St. Columb; Bodmin Moor; Tresowes, near Ashton in Breage; St. Buryan; Holm Bridge, three miles N.W. of Buckfastleigh; Sigford and Yarnour Wood, near Ilsington; Warren Tor;

Monk's Hill, Plaster Down, near Sampnird Spiney; Axtown; the Teign, the Bovey, West Dart, and many other streams in the Western part of Devonshire. Cassiterite has also been found in France, Spain, Germany, Sweden, Finland, Greenland, the United States, Mexico, Chili, Peru, Sumatra, Banca, Australia, &c.

Large pseudomorphous crystals of cassiterite after felspar occurred formerly in considerable abundance at Huel Coates, St. Agnes, some were like Fig. 179, but more compressed, others were macled. Many of the larger crystals "presented the curious circumstance of shewing the original felspar replaced by oxide of tin only about half across longitudinally." Similar pseudomorphs have been found at Carn Brecon, St. Mewan, near St. Austell; and also, about ten years ago, at Balleswidden, St. Just, by Mr. Richard Pearce.

The silicate of tin described by J. Garby is, perhaps, a pseudomorph after quartz. Some occurred about 1820 as an impalpable powder, or compact; yellowish-grey in color, and composed of 53·0 per cent. of oxide of tin and 46 per cent. of silica. According to Mr. J. Michell, some of the "silicate of tin was in hexagonal prisms, much like quartz, but with the summits always wanting."

Obs. The English crystals of cassiterite are usually small and bright; foreign crystals are often large and dull. Most of the tin stream works have yielded small quantities of gold from time to time. Wood-tin is said by Messrs. Greg and Lettsom to have been found about the year 1858 "in walls by the roadside, in fragments nearly as large as a man's head, the surface waterworn frequently, and often exhibiting that peculiar distribution of colour in superimposed bands of various shades of brown and yellow, from which this variety derives its trivial name."

Cassiterite is usually found in veins traversing granitic, schistose, or porphyritic rocks, and associated with quartz, fluor, schorl, chlorite, wolfram, mispickel, oxides of iron, pyrites, blende, and ores of lead and copper. It is harder and has a much lighter streak than wolfram, and has no cleavage, which in wolfram is always a well marked character. It is much harder than blende, and much heavier than garnet, schorl, or idocrase. Figs. 61 to 71 and Fig. 77 are all Cornish and Devonshire forms. Macles are commonly joined by the face e; the faces l, k, r, h, M, O are often rough or uneven; s and e are sometimes striated parallel to their intersections with each other. M is also sometimes striated.

Angles.

M M =	90°	00′	M z =	155°	00′
O M	90	00	O z	112	25
a a	90	00	s s	121	40
M y	119	43	s s′	87	07
M s	133	34	k k	163	00
M i	157	11	e e′	67	50
M l	175	10	z z′	118	18
M k	171	30	z z	159	06
M e	113	15	M r	168	41
M a	135	00			

CELESTITE.

[Celestine.] Rhombic; the crystals much resembling those of Barytes and Anglesite; often in tabular crystals, much like Figs. 130, 131, 132; some planes striated or rough; perfect basal cleavage parallel to O, less perfect cleavages parallel to M and M′; also compact, massive, fibrous, granular, earthy; brittle; fracture imperfectly conchoidal or uneven; transparent to translucent; vitreous to pearly; colourless, or white, grey, bluish, or reddish; sometimes pleochroic; streak white; H. 3-3·5; G. 3·8-4; pyrophosphoric.

B., etc. In matrass often decrepitates; on C fuses at 3 to a white pearly bead, colouring the flame carmine red, especially after being exposed to the R F and then treated with HCl; with soda melts, and sinks into the charcoal; with borax melts to a clear glass, which is opaque and yellowish or brownish when cold; insoluble in acids; soluble in HCl after exposure to the R F, the solution mixed with alcohol burns with a bright red flame.

Comp. Anhydrous sulphate of Strontia. No analysis of a specimen from the West of England is known, but foreign varieties contain from 40 to 46 per cent. of sulphuric anhydride, and 51 to 58 per cent. of strontia. With 43·6 of sulphuric anhydride, and 56·4 of strontia the formula will be SrS or $SrSO_4$ or SO_3Sro''.

Loc. Binner Down Mine, four miles north of Helston; Sidmouth, and other places on the south coast of Devonshire, in fissures of the cliffs, in thin crystalline transparent plates on gypsum, and in the cavities of flints; also Somersetshire, Gloucestershire, Yorkshire, Northumberland, Wales, Scotland, France, Spain, Italy, Germany, Hungary, North America, &c.

Obs. The name celestite is derived from cœlestis—sky blue—this colour is not, however, characteristic of the species,

but in some instances at least is due to the presence of a minute proportion of phosphate of iron.

Angles.

P M =	90°	00′	P d =	140°	35′
P M′	90	00	P o	127	56
M M′	104	02	P l	151	17

Cellular. When a mineral is full of small cavities or hollows it is termed "cellular; if the cavities are somewhat spherical, the term "vesicular" is used. Sometimes these hollows are large, and filled with matter of a different kind and colour, giving rise to the "amygdaloidal" structure. Pumice and Calamine are often cellular.

Cellular Pyrites. A cellular variety of bisulphide of iron, usually of marcasite.

CERUSSITE.

[White Lead Ore.] Rhombic; in prisms; often acicular and laterally aggregated; sometimes stellate or tabular (Figs. 140, 141, 142); sometimes a distinct cleavage parallel to M, the face a usually striated, O rough; sometimes massive, compact, fibrous, or earthy; brittle; fracture conchoidal or uneven; transparent to translucent, with powerful double refraction; lustre resinous, adamantine, or pearly; colourless, white, grey, greenish, or bluish, from the presence of a trace of copper, or sometimes with a dark brown or black tarnish; streak white; H. 3-3·5; G. 6·4-6·5.

B., etc. In matrass decrepitates, turns yellow, and at a high temperature red, but becomes yellow again on cooling, sometimes phosphoresces; on C decrepitates, fuses at 1, and is readily reduced to a malleable bead of metallic lead, depositing a yellow incrustation on the charcoal; insoluble in HCl, but readily soluble in dilute HNO_3, with effervescence.

Comp. Anhydrous carbonate of lead. No analysis of a specimen from the West of England is published. Foreign specimens are often pure. With oxide of lead 83·5, and carbonic anhydride 16·5 the formula will be $\dot{P}b\dot{C}$ or $PbCO_3$ or COPbo".

Loc. Pentire Glaze and St. Minver, in very thin snow-white tables (some of the crystals from Pentire Glaze were 10 inches long), and in fine needles; Huel Rose and Huel Penrose, near Helston, in delicate acicular prisms on Limonite; Huel Alfred; Huel Golden; Huel Ann; Great Retallack, West Chiverton, and other mines in Perranzabuloe; Huel Rose, Newlyn; Huel Confidence; Huel Crenver; Huel Primrose and Park Matthews, near St. Austell; East Tamar, in fine colorless crystals, with Anglesite, in decomposed galena; Hennock, near Chudleigh, in small acicular crystals; Beeralston; also Derbyshire, and other parts of England; Scotland, Wales, Ireland, France, Tyrol, Poland, Siberia, United States, &c.

Obs. It may be readily distinguished from all minerals that at all resemble it by its ready effervescence with dilute HNO_3 and its easy reduction on charcoal.

Angles.

M M =	117°	31′	O y =	149°	21′
M O	90	00	p p	130	00
O b	90	00	p p′	108	98
a b	90	00	k k	71	44
M a	121	24	i i	110	40
M i	145	20	a r	151	22
M k	125	52	a i	145	10

CERVANTITE.

[Antimonial ochre in part.] Rhombic (?) in acicular crystallizations; also earthy, pulverulent, investing, massive, or disseminated; brittle or friable; opaque; lustre greasy or pearly, glimmering or dull; yellowish or reddish-white to yellow; streak the same, but usually lighter, and shining; soft and friable; (Dana says H. 4-5;) G. 4-4·1.

B., etc. In matrass gives a little water, and with a strong heat a faint white sublimate; on C is easily reduced to a grey brittle bead of antimony, coating the charcoal with white, and tinging the oxidising flame green; soluble in HCl, the solution is sometimes partly precipitated by the addition of water.

Comp. Anhydrous binoxide of antimony, or else a mixture of antimonious and antimonic oxides. No analysis of a British specimen is known, but foreign specimens contain from 67 to 79 per cent. of antimony, and 16 to 20 of oxygen, with generally a little water of absorption. With antimony 79·2 and oxygen 20·8 the composition will be $\dot{S}b$ or $Sb_2O_3 + Sb_2O_5$.

Loc. Near St. Minvers; Huel Lea, on the Tamar; Huel Kine; Huel Boys, near Padstow; Port Isaac; Endellion; Trevinnock; Swanpool, near Falmouth; also France, Spain, Germany, Hungary, Mexico, &c.

Obs. It usually accompanies ores of antimony, and is sometimes pseudomorphous after antimonite.

Chalcedony. See Calcedony.

CHALCOCITE.

[Chalcosine. Copper Glance. Redruthite. Vitreous Copper.] Rhombic; in regular six-sided prisms, usually short and modified terminally; also obtuse six-sided pyramids; often macled, with the face O striated (Figs. 100 to 107); usually massive, lamellar, or compact; sectile or almost malleable; fracture conchoidal, even, or uneven; opaque; lustre metallic, brilliant to glimmering; blackish lead-grey, often a black or iridescent tarnish, or coated with green carbonate; streak greyish-black; H. 2·5-3; G. 5·5-5·8.

Var. Nail-headed copper ore is a macled variety (Fig. 104), so called from its resemblance to the heads of some nails.

B., etc. In matrass gives a slight white sublimate; on C fuses at 1, tinges the flame blue, gives off vapours of sulphurous anhydride, and emits sparks; with soda or alternate OF and RF yields a bead of metallic copper, leaving usually a little black infusible magnetic slag; decomposed by HNO_3.

Comp. Anhydrous subsulphide of copper. The following is an analysis of a specimen from the United Mines, Gwennap, by Thomson:—

Copper	77·16
Sulphur	20·62
Iron	1·45
Total	99·23

With copper 79·8 and sulphur 20·2 the formula will be Cu_2S.

Loc. Fine crystals, formerly at Levant (Figs. 100, 102); Botallack (Fig. 102); St. Ives Consols, in very fine crystals, lately like Figs. 104, 107, 108; Huel Crenver; Huel Abraham, in thin hexagonal plates, nail-headed copper, arborescent, and most of the forms 100 to 106; Camborne Vean; Cook's Kitchen (Fig. 116); Dolcoath, iridescent; Huel Fanny and North Huel Basset, in fine elongated and very perfect crystals; Huel Buller and other mines. Massive at most of the copper mines in Cornwall, especially Botallack, Spearn Moor, Levant, Ding Dong, Huel Neptune, and in an elvan course near Polgooth; Huel Betsy and other mines in Devonshire, in small quantities; also Yorkshire, Scotland, Ireland, Norway, Sweden, Germany, Siberia, North and South America, &c.

Obs. It may be distinguished from Fahlerz by its sectility and grey streak; from galena by the absence of cleavage and sectility; from pyrargyrite by its streak; from argentite by its blowpipe reactions; from Bournonite by its sectility; and from antimonite by its blowpipe reactions. All the Figs. from 100 to 107 represent forms which have occurred in Cornwall or Devon.

Angles.

O M =	90°	00′	O p =	117°	24′
O b	90	00	M M′	119	35
O a	90	00	d d′	125	38
O d	117	16	p p	126	54
O e	147	06	p a	116	32
O z	147	16	M a	120	12
O v	136	03			

Chalcolite. See Torbernite.

CHALCOPHYLLITE.

[Tamarite. Copper Mica. Rhomboidal Arseniate of Copper.] Hexagonal, in thin tables, like Fig. 201, with perfect cleavage parallel to O, or foliated masses, or druses; sectile, flexible; transparent to translucent; lustre adamantine, vitreous, or pearly; various shades of green; streak light green; H. 2; G. 2·4-2·7.

B., etc. In matrass decrepitates, yields much water, turns dark green to black, and with a strong heat deposits a white or straw-coloured sublimate; on C decrepitates, turns black, colours the flame blue or greenish, melts to a white globule of metallic appearance; with RF yields a strong garlic odour; with soda a bead of copper; soluble in HNO_3, and partially in ammonia.

Comp. Hydrated arseniate of copper and alumina.

The following are analyses of specimens from Cornwall, some, probably all, from Huel Gorland:—

	a.	b.	c.	d.	e.
Oxide of Copper	58·00	52·92	52·30	46·76	45·51
Arsenic anhydride	21·00	19·35	21·27	15·49	15·58
Alumina	—	1·30	2·13	5·69	6·25
Oxide of iron	—	—	—	0·60	0·61
Phosphoric anhydride	—	1·29	1·56	—	—
Water	21·00	23·94	22·58	31·46	32·05
Totals	100·00	99·30	99·84	100·00	100·00
Sp. Gr.	2·54	2·659	2·659	2·44	2·44

a. was analysed by Chenevix; b. and c. by Damour; d. and e. are recent and very careful analyses by Church. With oxide of copper 58·8, arsenic anhydride 21·2, and water 20·0 the formula may be written $8CuAs_2+12H_2$ or $3CuO, As_2O_5+5CuH_2O_2+7H_2O$ or $As_2O_3Cuo''_3+5CuHo_2+7OH_2$; this agrees pretty well with the analysis of Chenevix. With oxide of copper 53·6, arsenic anhydride 23·1, and water 24·3 it may be $8\dot{C}u\dot{A}s_2+14\dot{H}_2$

or $3CuO\ As_2O_5 + 5CuH_2O_2 + 9H_2O$ or $As_2O_2Cuo''_3 + 5CuHo_2 + 9OH_2$; this agrees somewhat more nearly with the analyses of Damour. With oxide of copper 45·39, alumina 7·35, arsenic anhydride 16·42, and water 30·84 the formula may be $8\dot{C}u\ddot{A}l_2As_2\ 24H_2$ or $Cu_3(AsO_4)_2 5H_2O + 5CuH_2O_2 + Al_2H_6O_6$ or $As_2O_2Cuo''_3 + 5CuHo_2 + Al_2Ho_6 + 5OH_2$. With oxide of copper 44·82, alumina 7·26, arsenic anhydride 16·21, and water 31·71 the formula may be $8\dot{C}u\ddot{A}l_2As_2 25H_2$ or $Cu_3(AsO_4)_2 6H_2O + 5CuH_2O_2 + Al_2H_6O_6$ or $As_2O_2Cuo''_3 + 5CuHo_2 + Al_2Ho_6 + 6OH_2$. Both these formulæ agree very closely with the analyses of Professor Church, and either of them may be taken as the correct one, since they only differ by one equivalent of water. Nearly half the water may be separated by drying in vacuo (hygroscopic moisture), while the rest is not driven off at 100°C (combined water).

Loc. Huel Gorland, Huel Muttrell, Huel Unity, Ting Tang, and other mines in Gwennap, but not recently; Huel Tamar (whence Brooke and Miller's name of Tamarite), Gunnislake; also Germany and Hungary.

Obs. Specimens may, perhaps, be obtained by carefully turning over the old burrows in copper mining districts. "The specimens which have been obtained lately are not so well crystallized as those which were raised formerly, neither do they equal them in colour: being of a pale verdigris green." (Greg and Lettsom, p. 316, 1858.)

Chalcophyllite occurs associated with other ores of copper, and is sometimes altered to Chrysocolla. It may be distinguished from Torbernite by its strong arsenical blowpipe reactions.

Angles.

R R′ =	110° 12′	e o =	124° 09′
R′ o	108 44	v o	124 09

v truncates the edge R′ o.

CHALCOPYRITE.

[Towanite. Copper Pyrites. Yellow Copper Ore.] Pyramidal; in more or less modified sphenoids, with e. p. striated, rough, or uneven; the sphenoid is very near a tetrahedron: often macled (Figs. 79 to 85); also stalactitic, botryoidal, or mammilated; usually massive, compact, lamellar, or disseminate; brittle or almost sectile; fracture conchoidal or uneven; opaque; lustre metallic, brilliant to glimmering; brass yellow, often with an iridescent tarnish; streak greenish-black; *scratch*, bright yellow and shining; H. 3·5-4; G. 4·1-4·3.

Var. Blistered copper is a botryoidal variety; peacock copper is a massive variety, with blue, red, green, brown, or iridescent tarnish, and often a lamellar structure.

B., etc. In matrass sometimes decrepitates, gives a yellow sublimate; on C melts to a black brittle magnetic globule; with soda and a little borax in R F gives a bead of copper; decomposed by HCl, forming a green solution and leaving yellowish powdery sulphur.

Comp. Sulphide of copper and iron. The following are analyses of Cornish specimens:—

	a.	b.	c.	d.
Copper.....	30·00	31·20	30·15	30·00
Iron	32·20	30·80	32·37	31·00
Sulphur ...	35·16	34·46	35·34	33·00
Silica.....	2·64	1·10	—	3·00
Lead, arsenic, loss, &c.	—	2·44	2·14	3·00
Totals ...	100·00	100·00	100·00	100·00

a., b., c. were analysed by Phillips, a. and c. being crystallized, b. botryoidal; d. was a specimen from Huel Towan, analysed by Michell. With sulphur 34·9, copper 34·6, and iron 30·5 the formula may be written $Cu_2S + Fe_2S_3$ or $Cu_2S + FeS + FeS_2$ or $CuFeS_2$.

Loc. Crystallized, East Pool, with chalybite, in sphenoids scarcely distinguishable from Fig. 33; Carn Brea, iridescent, on cubes of fluor; Tincroft; Dolcoath; Huel Tolgus, in obtuse rhomboids (pseudomorphous after dolomite?); Huel Buller, in very perfect sphenoids of one inch or more; Huel Towan, St. Agnes; Alfred Consols, Hayle, in very perfect rhombic dodecahedrons (Greg and Lettsom, 340), perhaps pseudomorphous after blende or erubescite; St. Just, in fine curved rhomboids (pseudomorphous after dolomite?); Levant Mine, pseudomorphous after Fahlerz; Herodsfoot, in double pyramids of three-quarters of an inch; Virtuous Lady Mine, in beautifully iridescent and large sphenoids; Ashburton; Huel Franco; Buckland Monachorum; Huel Robert; Sampford Spiney; Devon and Courtenay; Devon Great Consols; Huel Friendship; Willsworthy Mines; Copper Hill, Fursdon Manor, and other mines near Okehampton; Combemartin, North Moulton, Molland, Lundy Island, &c.; and other copper mines in the two counties.

Blistered Copper Ore.—Cook's Kitchen; Huel Basset; Dolcoath; Ale and Cakes; and other localities.

Massive and Iridescent (Peacock Copper Ore).—The United Mines, Gwennap; Gunnislake; Great Crinnis; South

Caradon; Virtuous Lady; Devon Great Consols, and many other mines, often associated with chalybite, blende, and cassiterite; also Cumberland, and several other English counties; Wales, Scotland, Ireland, Germany, Italy, Spain, Siberia, the United States, South America, Africa, Australia, &c.

Obs. It may readily be distinguished from pyrites and marcasite by its inferior hardness, from erubescite by its yellow scratch; from gold by its brittleness. A variety is described by Mr. John Garby as occurring near Gwinear—"fine-grained, *white streak*, pale yellow colour, 20 per cent. only of copper, and sufficient silver to pay for extraction." Another white variety from Huel Gorland, in Gwennap, yielded 40·0 of copper, besides iron, arsenic, and sulphur; it occurred with ordinary chalcopyrite.

Angles.

P P =	70°	07′	a a =	90°	00′
P P′	109	53	c d	140	47
P c	125	40	c x	155	05
P a	125	03	c v	152	33
P z	140	20	c z	116	54
P l	144	20	z z	101	50
m c	90	00	v x	148	06

Chalcosine. See Chalcocite.
Chalcotrichite. See Cuprite.

CHALYBITE.

[Siderite. Spathose Iron.] Hexagonal, in small obtuse or acute rhombohedrons, or lenticular, occasionally in hexagonal prisms (Figs. 195, 199, 202, 217, 220, 221, 224, 225, 231), often macled; cleavage rhombohedral, (R) perfect, often curved; some of the faces striated, rough, uneven, or curved; also massive, granular, lamellar, or compact; sometimes reniform or botryoidal; brittle; fracture subconchoidal or uneven; translucent to opaque; lustre adamantine, pearly, or silky, brilliant to glimmering; yellowish-white to dark-brown; often a dark tarnish from exposure to light; streak white, yellowish, or brownish; H. 3·5-4·5; G. 3·7-3·9; sometimes feebly magnetic.

Var. Wood Iron is a fibrous variety, of brownish colour and silky lustre.

Sphaerosiderite is a nodular, concretionary variety.

Slipper Iron is a pseudomorphous variety, which occurs in forms somewhat resembling a lady's slipper.

Clay Iron-stone is an argillaceous massive variety, rather a rock than a mineral.

Black Band is the same, but with a considerable mixture of carbonaceous matter.

B., etc. In matrass turns very dark and magnetic; on C the same; infusible; with borax or micro. gives Fe reactions; the powder is slowly soluble with effervescence in HCl or HNO_3.

Comp. Anhydrous carbonate of iron, with often a part of the iron replaced by Mn or Ca. No analysis of a specimen from the West of England is known, but a specimen from Durham gave—Oxide of iron 54·57, oxide of manganese 15·1, lime 3·18, carbonic anhydride 35·90. With oxide of iron 62·1 and carbonic anhydride 37·9, the formula would be FeC or $FeCO_3$ or COFeo".

Loc. Fine crystals at Huel Maudlin, near Lostwithiel (Figs. 195 and 202), also pseudomorphous after fluor; Huel Boulton, in six-sided prisms; Charlestown United, and other mines near St. Austell, very perfect and iridescent; Crinnis Mine, with drusy childrenite; Fowey Consols, in forms approaching to the octahedron (Fig. 224), tabular (Fig. 202), and crystals like Fig. 221, rich brown, translucent, and the faces slightly curved; near Bodmin, in hexagonal crystals, more than one inch long, like Fig. 195, attached to quartz; Bucker's Mine (Fig. 217); Dolcoath; Cook's Kitchen, East Pool and other mines in the neighbourhood of Camborne, and many other mines in Cornwall and Devon; Carnyworth and Huel Owles (Fig. 220 and other forms); Botallack, in brown rhomboids, like Fig. 119; Virtuous Lady, Huel Betsy, Huel Crebor, and Bedford United Mines, in fine spheroidal groups, made up of curved tabular crystals, of a rich hair-brown colour; Ivy Bridge, on quartz; Beeralstone, lenticular.

Wood Iron. — East Pool, Tincroft, Cook's Kitchen, Huel Buller, Huel Beauchamp, and other mines near Camborne and Redruth; East Crinnis, and other mines near St. Austell.

Sphaerosiderite.—Madron, near Penzance, and Mount Mine, near Marazion, in botryoidal masses resembling calamine.

Massive and compact.—Huel Rose and Huel Penrose near Helston; at Perranzabuloe; at the railway cutting near Plympton, of a beautiful white colour; Exmoor, and Combemartin, and other localities in the two counties; also many parts of England, Scotland, Wales, Ireland, France, Spain, Italy, Germany, Poland, United States, South America, &c.

Pseudomorphs.—The "Slipper Iron" found at Virtuous Lady, Beeralstone, and Huel Friendship is probably pseudomorphous after selenite. At Virtuous Lady hollow cubes of chalybite are also

found, from a very small size to three or four inches square; these are probably casts of fluor. In the interior of these "boxes," as they are called by the miners, fine crystals of chalcopyrite are sometimes found, together with beautiful groups of opaque white quartz crystals. In one instance this peculiar form of chalybite has been observed as a coating to a cube of fluor. At Beeralstone the chalybite occurs pseudomorphous after calcite.

A specimen of chalybite, almost chemically pure, was found by Mr. Wm. Vicary in the interior of a large flint near Haldon. It was a globular crystalline mass, of radiated structure and yellowish-grey colour.

Obs. Chalybite may be distinguished from childrenite by its inferior hardness, different crystalline form, and usually the absence of any reactions for phosphoric acid before the blowpipe; from calcite and dolomite by its becoming black and magnetic when heated in a matrass. The massive varieties often contain some phosphoric acid.

Angles.

R R =	107°	00′	b b′ =	120°	00′
R o	136	37	v v	144	56
e e	136	34	v v′	105	15
m m	66	18	v v″	134	40
s s	64	10	v o	121	25
s o	101	57	b a	150	00
o e	154	43	R v	150	45
o m	104	49	f f	80	06
o a	90	00	o u	163	00
a a′	120	00	o f	117	53

f is a rhombohedron of 80° 06′, and truncates the angle e′ a; u forms a rhombohedron of about 120° and truncates s a. Besides Figs. 195, 199, 202, 217, 220, 221, 224, 225, 231, the following forms and combinations have all been found in Cornwall or Devon, viz.,—f, s, f a, a o, R o, R a O, R m f, R o u, R o s e, R a o s e, R a o e, R s b, R v, R v b, R a o f e.

Chemical Characters of Minerals. Those which depend upon their chemical composition, as taste, odour, solubility, fusibility, and the reactions with soda, borax, and micro.

Chemical Equivalents. See Table of the Elements in part 1.

CHENEVIXITE.

Massive; compact; opaque; vitreous; dark dull green, passing into yellow; streak yellowish-green; H. 4·5; G. 3·93 (?)

B., etc. In matrass decrepitates, gives off water, and turns brown; on C fuses easily to a black magnetic scoria, giving off arsenical fumes; easily soluble in HCl or HNO_3.

Comp. Hydrated arseniate of iron and copper. Analyses:—

	a.		b.
Arsenic anhydride	33·50	...	32·20
Oxide of copper	22·50	...	31·70
Oxide of iron	27·50	...	25·10
Phosphoric anhydride	—	...	2·30
Lime	—	...	0·34
Water	12·00	...	8·66
Totals	95·50	...	100·30

Both were Cornish specimens, a. was analysed by Chenevix, b. by Adam, recently. With arsenic anhydride 34·2, oxide of copper 29·9, oxide of iron 26·9, and water 9·0 the formula may be written $\dot{2}\dot{A}s_2\dot{5}\dot{C}u\dot{5}\dot{F}e\dot{8}\dot{H}_2$ or $(As_2O_5)_2Cuo''_3Feo''_3+CuHo_2FeHo_2+4OH_2$ or $3CuOAs_2O_5+2CuH_2O_2=3FeOAs_2O_5+FeH_2O_2+4H_2O$.

Loc. Cornwall, in small compact masses, so imbedded in quartz rock that it is not possible to separate them completely.

Obs. Probably specimens might be found by a careful examination of old collections.

Chenocoprolite. See Pitticite.

CHESSYLITE.

[Azurite. Lazulite. Blue Malachite. Blue Copper.] Oblique; crystals usually small and short prismatic or tabular (Fig. 154), with striated or rough faces; also botryoidal, stalactitic, investing, disseminate, massive, compact, earthy; brittle; fracture conchoidal, uneven, or splintery; vitreous to adamantine; deep blue; streak blue, lighter than color; H. 3·5-4; G. 3·5-3·8.

B., etc. In matrass decrepitates, turns black, and gives off water; on C fuses and yields a bead of copper; soluble with effervescence in HCl or HNO_3, more slowly in ammonia.

Comp. Hydrated carbonate of copper. No analysis of a British specimen is published, but a specimen from Chessy yielded—Oxide of copper 69·09, carbonic anhydride 25·69, water 5·22, which agrees with the formulæ $3\dot{C}u, 2\ddot{C}, \dot{H}_2$ or $2CuCO_3+CuH_2O_2$ or $2COCuo''+CuHo_2$.

Loc. Huel Gorland, Huel Unity, Huel Virgin, Ting Tang (prettily crystallized), Carharrack, all in Gwennap; Huel Muttrell, Huel Mill Pool (once, crystallized); Huel Buller, near Redruth (Fig. 154 and P s h l the faces h predominating); and in small quantity in most of the Cornish copper mines;

East Tamar, near Beerferris, in good crystals; Devon Great Consols, and other copper mines in Devon; also at Chessy, near Lyons, where the best crystals have been obtained; Thuringia, Moldavia, Ural, Siberia, United States, &c.

Obs. Chessylite is usually found lining cavities in the older rocks, with malachite and cuprite. It is, perhaps, a decomposition product. When abundant it is ground up for use as a pigment.

Angles.

M M =	99°	32′	P h =	111°	46′
M θ	57	11	P M	91	48
11	119	16	P θ	132	50
h h	106	14	P s	135	13

The more common British forms are P h l, P h l s, and Fig. 154.

Chiastolite. See Andalusite.

CHILDRENITE.

[Rhombic; in small modified pyramids, like Fig. 146, or tabular crystals, like Figs. 143, 144, 145; or druses; fracture uneven; translucent; vitreous to resinous, brilliant; yellowish or brownish; streak pale yellowish-brown; H. 4·5-5; G. 3·2.

B., etc. In matrass gives off water, which does not usually affect test paper; on C is infusible, or swells up and fuses on the edges to a dark mass, and colours the flame bluish-green; with borax and micro. gives the Fe and Mn reactions; the powder slowly soluble in HCl.

Comp. Hydrated phosphate of iron, alumina, and manganese, as appears from the following analysis of a Cornish specimen by Rammelsberg;—

Phosphoric anhydride	28·92
Alumina	14·44
Oxide of iron	30·68
Oxide of manganese	9·07
Magnesia	0·14
Water	16·98
Total.	100·23

With oxide of iron 29·3, oxide of manganese 9·6, alumina 14·0, phosphoric anhydride 29·1, and water 18·0 the formula

. . . . . .

may be $6Fe\ 2Mn\ 2Al_2\ 3P_2+15H_2O$ or $P_3O(Al_3O^{VI})_2Fe''_6Mn''_2+15OH_2$.

Loc. Crinnis Mine, near St. Austell, on slate, sometimes with apatite, in small distinct crystals, like Fig. 146; Huel Crebor, in distinct crystals, like Fig. 143, embedded in greyish-green chloritic earth; George and Charlotte Mine, Tavistock, in large and brilliant crystals, like Fig. 145, some one inch in length, on quartz, chalybite, and pyrites; Devon and Cornwall United Mines. It occurs also in Cumberland and the United States.

Obs. It may be mistaken for chalybite, but may be distinguished by its crystalline form and superior hardness.

Angles.

O r =	109°	53′	s s′ =	130°	04′
O s	114	58	s s	102	41
O n	142	07	n n′	75	46
O a	152	22	r n	139	08
O o	90	00	r s	168	29
r r′	119	32	s n	137	26

China Clay. See Kaolin.

China Stone. This is a decomposed or imperfectly formed white granite, abundant in the neighbourhood of St. Austell, Breage, St. Day, and other places in Cornwall. It is used for making the finer kinds of pottery.

Chloanthite. See Smaltite.

Chloride of Silver. See Kerate.

Chloride of Sodium. See Halite.

Chlorides. Salts composed of a metal in union with chlorine. All the chlorides, except those of silver, lead, and mercury, are readily soluble in water, and have a distinct taste. From their solubility they are not common as minerals, with the exception of Rock Salt or Halite. The chlorides found in the two counties are—

Kerate,	*Botallackite,*
Halite,	*Tallingite,*
Atacamite,	*Cromfordite.*

Cromfordite is a chloro-carbonate. Atacamite is an oxy-chloride.

CHLORITE.

[Prochlorite. Dana.] Hexagonal; crystals very rare; usually thin hexagonal plates, often grouped together in rosettes; cleavage basal, very perfect; massive; foliated, the folia flexible, but scarcely at all elastic; generally scaly, compact, or earthy; investing, pseudomorphous, or disseminated; sectile; fracture earthy or slaty; unctuous; semitransparent to opaque; lustre pearly or sub-metallic; shining or dull; various shades of green, sometimes blue, greyish, yellowish, or brown; crystals dichroic; streak white, or like the colour, but paler; H. 1-2; G. 2·7-3·0.

B., etc. In matrass gives off water, becomes lighter in colour; on C fuses at 5 (?) to a magnetic mass, which, with borax and micro., gives iron reactions; in the forceps glows with a bright light, but is scarcely fusible; insoluble in HCl or HNO_3. Partly soluble in warm concentrated H_2SO_4.

Comp. Hydrous silicate of alumina, magnesia, and iron. No analysis of a

British specimen is published, but foreign specimens yield from 25·0 to 28·0 per cent. of silica, 14·5 to 22·0 of alumina, 15·0 to 29·0 of oxide of iron, 13·0 to 31·0 magnesia, 9·0 to 14·0 of water. With silica 26·9, alumina 19·8, oxide of iron 27·6, magnesia 15·3, water 10·4 the formula may be $6\dot{F}e\ 6\dot{M}g\ 3\dot{A}l_2\ 7\dot{S}i\ 9\dot{H}_2$ (oxygen ratio for $\dot{R}\ddot{R}_2\dot{S}i\ddot{H}_2 = 12:9:14:9$. for bases and silica 3 : 2) or (4-7ths $\dot{M}g\ \dot{F}e)^3 + (3\text{-}7\text{ths}\ \ddot{A}l_2)\dot{S}i + 4\text{-}3\text{rds}\dot{H}_2$ or $Si_7O_2(Al_2Ho_6)_2Feo''_6Mgo''_6$.

Loc. Chlorite occurs in most of the tin mines of the two western counties. At Virtuous Lady Mine it often contains fine crystals of mispickel, and sometimes small crystals of anatase and brookite; at Carn Brea, Great Huel Vor, Huel Prospidnick, and other mines it contains beautiful striated cubes, and pentagonal dodecahedrons of pyrites disseminated through it; at New Rosewarne, near Gwinear, it occurs in foliated and radiated masses, with quartz, killas, breccia, and sometimes cassiterite, and also in the form of a "cap" on quartz crystals. At Wherry Mine, near Penzance, a conglomerate of chlorite pebbles, cemented by oxide of tin, contained pure crystals of tin. In some of the mines near St. Day small crystals of fluor are found embedded in chlorite; at Botallack it sometimes contains small particles of cobaltite. It occurs pseudomorphous after felspar in much of the granite to the south and west of Carnmarth; at the Consolidated Mines in the form of albite; at North Roskear, in pseudomorphous octahedrons, perhaps after fluor; on Dartmoor and at St. Just, in the form of axinite; at Tresavean, in octahedrons, perhaps after magnetite. It also occurs in Cumberland, Westmoreland, Wales, Scotland, Ireland, Germany, Tyrol, and most mining countries.

Obs. Chlorite often contains disseminated crystals of pyrites, hornblende, magnetite, fluor, quartz, and sometimes garnet. In Cornwall it is known as "Peach," and is especially associated with cassiterite.

Chlorocarbonate of Lead. See Cromfordite.

Chloromelane. See Cronstedtite.

CHLOROPAL.

[Nontronite. Pinguite. Gramenite.] Amorphous, massive, compact, opaline or earthy; fragile; fracture conchoidal, splintery, or earthy; opaque to subtranslucent; resinous to dull; green or yellowish-green; H. 0 to 4·5; G. 1·7-2·1.

Var. 1. Chloropal. H. 2·5-4·5; meagre; adherent; brownish or yellowish-green.

2. Nontronite. H. 2·5-4·5; yellow or greenish; unctuous.

3. Pinguite. H. 0-1; green; non-adherent.

4. Gramenite. Fibrous or feathery, grass-green.

B., etc. In matrass gives off water and becomes darker; on C infusible; turns black and magnetic; with borax and micro. gives the reactions for iron and silica. Chloropal is partly decomposed by HCl. Pinguite is completely decomposed with separation of powdery silica. Nontronite is decomposed, and deposits gelatinous silica.

Comp. Hydrated silicate of iron. No analysis of a British specimen is known to the author, but foreign specimens contain of silica 39 to 71 per cent., peroxide of iron 38·0, and water 19·2, the formula may be written $2\dot{F}e_2\ddot{6}\dot{S}i + 9\dot{H}_2$ (oxygen ratio = 1 : 2) or $Si_6O_6(Fe_2o_{VI})_2 9\dot{O}\dot{H}_2$.

Loc. Chloropal is abundant in a quarry at Carn Gray; near Carclaze Mine, St. Austell, of a greenish-brown colour, with fluor, in fissures of the decomposed granite; Tremearne, Breage (Pinguite?); it is found also in Germany, Hungary, and Ceylon.

Obs. Careful analyses of this mineral are much required.

Chlorophane. See Fluor.

CHONDRODITE.

[Humite.] Rhombic; in very small complex crystals, like 153; sometimes macled, usually in embedded grains or granular masses; fracture sub-conchoidal or uneven; transparent to nearly opaque; vitreous or resinous; white, yellow, brown, red, green, grey, black; streak white or slightly yellow or grey; H. 6-6·5; G. 3·1-3·3.

B., etc. In matrass no change, or turns first darker and then white; on C infusible, changes colour sometimes; with micro. in the open tube gives the reaction for fluorine; with borax or micro. yields iron reactions; decomposed by HCl, yielding a deposit of gelatinous silica.

Comp. Anhydrous silicate of magnesia, containing some fluorine. No analysis of a British specimen is known. Foreign specimens yield from 32·0 to 36·0 per cent. of silica, 51·0 to 60·0 of magnesia, and 3·0 to 10·0 of fluorine, which, perhaps, only replaces a part of the oxygen. With magnesia 64·0 and silica 36

the formula might be $8Mg\,3\dot{S}i$ (oxygen ratio = 4 : 3) or with silica 35·3, magnesia 60·0, and fluorine 7·7 the formula may be $Si_3Mgo''_6(MgFO)_2$.

Loc. It is said to have been found at Huel Druid, near Redruth; it occurs also in Scotland, Ireland, Germany, Russia, Canada, United States, &c.

Obs. The crystals are usually very small, very much modified, and embedded in granular limestone, or granite, or volcanic rocks. It more often occurs in rounded granular masses or very indistinct prisms. Fig. 153 represents a crystal of chondrodite from New Jersey.

Angles.

M M′ =	85° 00′	d z =	136°
d d′	112	z z′	127

Chromates. Salts composed of chromic anhydride, in combination with a metallic oxide; or chromic acid in which the hydrogen is displaced by a metal. The chief mineral chromates are those of iron and lead (chromite and crocoisite). Of these only the first has been found in Cornwall or Devon.

CHROMITE.

[Chrome Iron Ore.] Cubical; in octahedrons (Fig. 1), with imperfect octahedral cleavage; or massive; more usually disseminated in grains; fracture imperfect conchoidal or uneven; opaque; lustre sub-metallic or resinous; brownish-black; streak yellowish to reddish-brown; H. 5·5; G. 4·4-4·5; sometimes weakly magnetic.

B., etc. In matrass unchanged; on C infusible, but becomes somewhat browner; non-magnetic varieties become magnetic when heated in R F; with borax forms an emerald-green bead; with micro. the same; when fused with nitre a yellowish mass is formed, which produces a yellow solution if dissolved in water; scarcely affected by acids.

Comp. Chromate and aluminate of iron. Foreign specimens contain from 36·0 to 60·0 per cent. of chromic peroxide, 9·0 to 21·0 per cent. of alumina, and 18·0 to 37·0 per cent. of oxide of iron. The alumina is regarded as replacing a part of the chromic peroxide. The oxide of iron is also in some cases partly replaced by magnesia. With 32·0 per cent. of oxide of iron and 68·0 of chromic peroxide the formula may be written $FeCr_2$ or $FeCr_2O_4$ or Cr_2O_3Feo''.

Loc. It was reported from the Lizard district many years ago, by Mr. Michell, of Calenick. It has been lately re-discovered in a quarry near Cadgwith, by Mr. Richard Pearce, F.G.S., of Swansea. The serpentine rock when analysed yielded an amount of chromic peroxide which was estimated as equal to 1·3 per cent. of the whole. A portion of the chromite, mechanically separated, yielded 30·0 per cent. of chromic peroxide. Also in Scotland, the Shetland Isles, France, Germany, Norway, United States, &c.

Obs. Chromite is used in the preparation of a considerable variety of pigments, as chrome-green, chrome-yellow, &c. It is usually found associated with serpentine rocks or in crystalline limestones.

CHRYSOCOLLA.

[Silicate of Copper. Siliceous Oxide of Copper.] Amorphous; globular, stalactitic, reniform; massive, investing, disseminate, pseudomorphous; brittle; fracture conchoidal or splintery; translucent to nearly opaque, resinous or waxy; shining to dull; green or blue, sometimes brownish or almost white; streak white or slightly greenish; H. 2-3; G. 2·2 to 2·3.

B., etc. In matrass gives off water and turns black; on C infusible, blackens in O F, reddens in R F; with soda yields a red malleable bead of copper; with borax gives Cu reactions; slowly soluble in HCl without effervescence, forming a green solution and depositing gelatinous silica.

Comp. Hydrated silicate of copper. No analysis of a British specimen is published, but foreign specimens contain from 26·0 to 52·0 per cent. of Silica; 27·0 to 45·0 per cent. of oxide of copper, and 16·0 to 31·0 per cent. of water, besides small quantities of alumina, magnesia, lime, potash, and oxide of iron. With silica 34·2, oxide of copper 45·3, and water 20·5, the formula may be $\dot{C}u\dot{S}i2H_2$ (oxygen ratio 1 : 2 : 2) or $CuSiO_3 + 2H_2O$ or $SiOCuo'' + 2OH_2$ or $SiO_3CuHo_2 + OH_2$.

Loc. Huel Edward, St. Just, with aragonite; many parts of the Lizard district, with native copper; Ting Tang; Huel Gorland; Huel Muttrell; Huel Unity; West Huel Jewel, and other mines near St. Day; Prince George Mine, Gwinear; Huel Trannack; Phœnix Mine; Gunnislake; and in most of the copper mines of the two counties in small quantities; also Cumberland, Westmoreland, Wales, Scotland, Ireland, Germany, Hungary, Italy, Siberia, North America, Chili, Australia, &c.

Obs. It may be readily distinguished from malachite by the absence of effervescence when treated with dilute HCl;

from atacamite by its insolubility in ammonia; from the arseniates and phosphates of copper by its infusibility. Pseudomorphs after cuprite and mica have been found in Cornwall.

Chrysoprase. See Calcedony.

Chrysotile. A fibrous variety of serpentine much resembling asbestos. (See Serpentine.)

CHURCHITE.

Oblique? fan-like aggregations of minute crystals, with one perfect and several less distinct cleavages; also radiated and columnar; brittle; fracture conchoidal; transparent to translucent; vitreous, pearly on terminal planes; pale smoke-grey tinged with flesh-red; streak and powder white; H. 3, or a little above; G. about 3·14.

B., etc. In matrass gives off water with an acid reaction, and becomes opaque; on C becomes reddish in O F, but is infusible; with borax in O F gives a bead which is orange yellow and opaline while hot, colourless or slightly amethystine when cold.

Comp. It is a hydrated cerous phosphate, as appears from the following analysis, the mean of several, made by Professor A. H. Church, of Cirencester:—

Phosphoric anhydride	28·48
Oxide of cerium	51·87
Lime	5·42
Water	14·93
Total	100·70

With 52·7 of oxide of cerium, 5·5 of lime, 27·8 of phosphoric anhydride, and 14·0 of water the formula may be written $\dot{5}\dot{C}e, \dot{C}a, \dot{2}\dot{P}_2+8\dot{H}_2$ (oxygen ratio 3 : 5 : 4) or $(5\text{-6ths } \dot{C}e\ 1\text{-6th } \dot{C}a)^3\dot{P}_2+4\dot{H}_2$ or $P_4O_4Ceo''_5Cao'' + 8OH_2$. Professor Church also obtained a trace of fluorine, and Mr. C. G. Williams detected didymium by means of the spectroscope.

Loc. It was discovered by Mr. Talling, near Lostwithiel, in a copper lode, investing quartz and killas, forming a coating of minute crystals about one-tenth of an inch thick. Professor Church has since detected it in several Cornish apatites from different localities.

Obs. The cleavage is supposed to be basal by Mr. N. S. Maskelyne, but clinodiagonal by Dana. This is the first British mineral which has been found to contain cerium. It is well known that didymium is usually found in minerals containing cerium, and it is interesting to find that this is no exception to the rule, although found in a new locality.

For detailed descriptions of the method of analysis, &c., see Journal of the Chemical Society, and Chemical News, for 1867-8.

Citrine. See Quartz.

Clay. See Kaolin.

Clay Ironstone. See Chalybite.

Cleavage. A property possessed by many minerals of splitting more readily in certain definite directions than in others, and affording shining surfaces, usually plane, but sometimes curved, called "cleavage planes;" these cleavage planes have often a pearly lustre, even when the general lustre of the mineral is not pearly. The cleavages are usually parallel to some of the primary forms.

Cleavelandite. See Albite.

Cleiophane. See Blende.

CLINOCLASE.

[Klinoclase. Clinoclasite. Oblique Prismatic Arseniate of Copper.] Oblique; in small crystals, like Figs. 163 to 166; with a perfect cleavage parallel to O, more commonly in wedge-shaped or hemispherical aggregates, with curved cleavage; and radiated, fibrous, or columnar structure; brittle; translucent to opaque; lustre vitreous, pearly, or resinous; dark green or dark blue; streak bluish-green; H. 2·5-3; G. 4·2-4·4.

B., etc. Altogether like Olivenite, which see.

Comp. Hydrated arseniate of copper, as appears from the following analyses:—

	a.	b.
Arsenic anhydride	29·71	27·09
Oxide of copper	60·00	62·80
Phosphoric anhydride	0·64	1·50
Peroxide of iron	0·39	0·49
Lime	0·50	—
Silica	1·12	—
Water	7·64	7·57
Totals	100·00	99·45

The sp. gr. of a. was 4·258 (4·359 when powdered); that of b. was 4·312. a. was analysed by Rammelsberg; b. by Damour; both were Cornish specimens. With arsenic anhydride 30·2, oxide of copper 62·7, and water 7·57 the formula may be written $6\dot{C}u\dot{A}s_2+3\dot{H}_2$ (oxygen ratio = 6 : 5 : 3) or $(CuO)_3As_2O_5+3CuH_2O_2$ or $As_2O_2Cuo''_3(CuHo_2)_3$.

Loc. Ting Tang; Huel Unity; Huel Muttrell; Huel Gorland, and other mines near St. Day, formerly; Providence Mine, Lelant; and more recently at Bedford United Mines, near Tavistock, in hemispherical masses of a pure dark bluish-green colour; also found in Germany.

Obs. It may be distinguished from chalcophyllite by its higher specific gravity and darker colour, as also by its deflagration on charcoal (chalcophyllite fuses quietly); from torbernite it may be distinguished by its different blowpipe reactions and darker colour. The crystals may always be recognised by their form. Allan observes, "The crystals usually present a very dark blue colour and brilliant lustre," and "are easily recognisable, being aggregated in divergent groups, or disposed in extremely minute individuals in cavities in quartz."

Angles.

M M′ =	56°	00′	O r =	123°	48′
M′ O	95	00	r a	155	42
O s	80	30	s a	161	00
O a	99	30	M a	118	00

Clinodiagonal. The inclined lateral axis of oblique crystals is so called; a cleavage plane parallel to this axis and the principal is called a clinodiagonal cleavage. Thus a cleavage parallel to b. in Fig. 160 will be clinodiagonal; parallel to a. would be *orthodiagonal.*

Coal. This is rather a rock than a mineral, but a few words here will not be out of place. The most evident grouping of the different varieties of coal is as follows:—

1. Anthracite.
2. Cannel Coal.
3. Caking Coal.
4. Brown Coal or Lignite.

Of these only the first and the last have occurred in the two western counties, and these mostly in Devonshire.

The Lignites of Bovey Tracey have been worked in connexion with its clays for many years.

The following is an analysis of the Bovey Lignite, by Vaux (Journ. Chem. Soc. 1, 318, 1869):—

Carbon	66·31
Hydrogen	5·63
Oxygen	22·86
Nitrogen	0·57
Sulphur	2·36
Ash	2·27
Total	100·00

"Thin intermittent beds of Anthracite stretch eastwards from Abbotsham, on the shores of Barnstaple Bay, through Bideford in a straight line to Hawkridge Wood, near Umberleigh, a distance of about twelve miles." (Report Devon Assoc., 11, 11, p. 345.) Anthracite has been worked also at Tavistock. The author found a shining black carbonaceous coating in the joints of the killas at Huel Jane (near Truro), and near Hayle. That from Huel Jane when scraped off and dropped into melted nitre, deflagrated, thus shewing its carbonaceous nature.

Cobalt Bloom. Cobalt Coating. Cobalt Crust. See Erythrite.

COBALTITE.

[Cobaltine. Cobalt Glance. Bright White Cobalt.] Cubic; in crystals like Figs. 1, 2, 8, 32, 43, 45, 46, 48; cleavage perfect, parallel to a, the faces a usually striated as in pyrites; more commonly massive, compact, granular, or disseminate; or stalactitic, botryoidal, reniform, arborescent; brittle; fracture uneven; opaque; lustre metallic; silvery or reddish-white, grey or greyish-black; streak greyish-black; H. 5·5·5; G. 6·6·3.

B., etc. In matrass is unaltered, or gives a light yellow or white sublimate; on C yields copious arsenical and sulphureous fumes, deposits a white incrustation, and fuses to a grey brittle magnetic globule; with borax and micro. yields Co reactions; decomposed by warm HNO_3, depositing arsenious anhydride and sulphur.

Comp. Sulpharsenide of cobalt, often with nickel and iron. No analysis of a British specimen is known, but foreign specimens contain from 19 to 21 per cent. of sulphur, 43 to 45 arsenic, and 9 to 33 cobalt. With 19·3 of sulphur, 45·2 arsenic, and 35·5 cobalt the formula may be written CoSAs or CoS_2+CoAs_2 or $Co(SAs)_2$.

Loc. Botallack, in small particles, embedded in reddish quartz and chlorite; it is said to have been found also at the Wherry Mine, Penzance; Dolcoath; Huel Sparnon; and St. Austell; also Sweden, Norway, Germany.

Obs. The crystals are most readily distinguished from smaltite by their cleavage.

Angles. Same as pyrites.

o o = 109° 28′ a a = 90° 00′ &c.

Cockle. See Tourmaline.

Cockscomb Pyrites. See Marcasite.

Cogwheel Ore. See Bournonite.

Colour. A physical character, which is of considerable importance and very distinctive in minerals which have a metallic or submetallic lustre, as Pyrites, Galena, Wolfram, &c., but of very little importance in those whose lustre is vitreous or resinous, as Cassiterite, Blende, Quartz, Calcite, &c. *Varieties* of these species are, however, often founded upon colour alone.

Columnar. Made up of small columns. See Physical Characters of Minerals (Structure).

Common Felspar. See Orthoclase.

Common Spar. See Quartz.

Compact. A term applied to specimens which exhibit no peculiarity of structure. See Physical Characters of Minerals (Structure).

Concentric lamellar. A structure resembling that of an onion. See Physical Characters (Structure).

Concretion. Grown together. Nodules like those of chert and ironstone, the grains and spherules of oolite, and the grape-like clusters of the magnesian limestone are termed "concretions," as formed by a molecular aggregation, distinct from crystallization. (Page, Handbook of Geological Terms.)

Conchoidal. Shell-like. When a mineral breaks with a curved fracture, somewhat like the inside of a shell, it is said to be conchoidal. *Ex.* Flint.

Condurrite. See Domeykite.

CONNELLITE.

Hexagonal; in small acicular crystals, like Figs. 228, 229; translucent; lustre vitreous; colour fine blue; streak light blue (?)

B., etc. In matrass yields a little water with acid reaction, and decrepitates; on C tinges the flame greenish-blue and fuses to a reddish globule; with soda yields a bead of copper; the slag gives the reaction for sulphur when moistened and placed on silver; soluble in HCl or HNO_3.

Comp. Hydrated sulphatochloride of copper. No quantitative analysis is known.

Loc. Huel Providence; Huel Unity; and Huel Damsel, formerly, in slender prisms, like Figs. 228, 229; also fibrous or massive, in thin veins with other copper ores.

Obs. The colour of the massive mineral is much darker than that of the fibres or crystals. Only a few specimens are known, and these were all obtained many years ago. The crystals are about 1-10th of an inch in length, and 1-200th in thickness. Specimens may, perhaps, be found in old collections ranged with the arseniates and phosphates of copper.

Angles.

P P over summit =	73°	40′
P P adjacent	132	50
P a	143	10
P c	133	53
w w′	163	50
w w″	137	10
w c	156	02
w a	166	54
P w	152	37
a c	150	00
c c	120	00
a a	120	00

Observed forms P w a c, P c.

COPPER.

[Native Copper.] Cubic; in modified octahedrons, cubes, &c.; crystals like Figs. 8 to 16, 59, 60, but usually indistinct; often macled, or aggregated to form dendritic, capillary, or interlacing masses, also in thin laminæ or massive; malleable; fracture hackly; opaque; lustre metallic; copper-red, often with a brown tarnish, or thin green coating of malachite; streak light red and shining; H. 2·5; G. 8·5-9·0.

B., etc. In matrass unaltered, or darkens on the surface somewhat; on C fusible at 3 to a bead which is bright while hot, but covered with a dull black crust of oxide when cold, and generally tinges the flame slightly green; when moistened with HCl and heated colours the flame intensely blue; soluble readily in HNO_3, forming a green solution and giving off orange coloured fumes.

Comp. Copper, almost pure; containing sometimes a little iron, silver, or bismuth.

Loc. Botallack, Huel Cock, and other mines at St. Just, in ramose and mossy aggregations; many parts of the Lizard district, in the joints of the serpentine; Bellurian Cove and the Ghostcroft, near Mullion; Pradannack, in conglomerate with pyrites; Binner Downs and Trenance, near Helston; Leseave, Trewavas, New Hendra, and Huel Prosper, in Breage, (in thin veins); Owen Vean, St. Hilary; Providence and other mines near St. Ives; East Relistian, and other mines in Gwinear; Huel Crenver, in Crowan; Huel Gorland, Huel Unity, and other Gwennap mines (Figs. 1, 2, and other forms, and in thin leaves filling joints in quartz); Huel Buller, Huel Basset, and other mines near Carn Brea; Tresavean, lately, in arborescent forms with chlorite and oxide of iron; Condurrow, Dolcoath, Cook's Kitchen, and the mines near Camborne; Carn Brea and Huel Druid, like Fig. 1, with a dull brown tarnish, and also in thin plates, dendritic, and mossy; Huel Music, Polberrow, and other mines in St. Agnes; Great St. George Mine, Perranzabuloe; Crinnis and Great Dowgas, near St. Austell; East Crinnis, Par Consols, and Lanescot, near St. Blazey (reticulate); Gunnislake; West Caradon; Fowey Consols; Phœnix; Devon and Courtenay, Devon Great Consols, Huel Crebor, and other mines near Tavistock; also many other parts of England; Wales, Scotland, Ireland, and most of the countries in Europe, and many parts of Asia, Africa, America, and Australia.

Obs. Copper may be readily recognised

by its colour when freshly cut, and its malleability. Figs. 3 and 4 are compressed macles observed in Cornish specimens.

Angles.

o o	= 109°	28′	a d	= 135°	00′
a a	90	00	a e	153	26
d d	120	00	e e′	143	08
a o	125	16	d e	161	34
d o	144	44			

Copper Black. See Melaconite.
Copper Glance. See Chalcocite.
Copper Green. See Chrysocolla.
Copper Mica. See Chalcophyllite and Torbernite.
Copper Nickel. See Niccolite.
Copper Pyrites. See Chalcopyrite.
Copper Vitriol. See Cyanosite.
Copper Uranite. See Torbernite.
Copperas. See Melanterite.
Coralloid. Branched like a coral. *Ex.* flos-ferri.
Cornish Diamond. See Quartz.
Cornish Tin Ore. See Cassiterite (Wood Tin).

CORNWALLITE.

Amorphous; reniform, or minutely botryoidal; compact or disseminate in or on Olivenite; brittle; fracture conchoidal; lustre non-metallic; rich verdigris or dark green; streak the same; H. 4·5; G. 4·1-4·3.

B., etc. In matrass and on C like Olivenite.

Comp. Hydrated arseniate of copper, as appears from the following analyses:—

	a.	b.	c.	d.
Arsenic anhydride	29·78	30·65	30·00	29·00
Phosphoric anhydride	2·54	1·77	—	—
Oxide of copper	55·00	54·22	54·00	51·00
Water	12·68	13·36	16·00	18·00
Total	100·00	100·00	100·00	98·00

All were Cornish specimens. a. and b. were analysed by Lerch; c. and d. by Chenevix; the sp. gr. of d. was 4·28.

Another analysis by Lerch (e.) is given below, compared with two recent analyses by Church. (f. and g.)

	e.	f.	g.
Oxide of copper	54·61	59·95	58·33
Arsenic anhydride	30·21	30·47	33·75
Phosphoric anhydride	2·16	2·71	—
Water	13·02	8·25	7·92
Totals	100·00	101·38	100·00

In the analyses f. and g. the water is much less than in the other. If in the earlier analyses the water were merely determined by difference, the anomaly might easily be explained. With arsenic anhydride 32·0 per cent., oxide of copper 55·4, and water 12·6 the formula may be written $\dot{A}s_2\dot{5}Cu\dot{5}H_2$ or $Cu_32AsO_4 + 2CuH_2O_2 + 3H_2O$ or $As_2O_2Cuo''_3 + 2CuHo_2 + 3OH_2$. This shews it to be closely related to ehlite. Church adopts the formula $\dot{A}s_2\dot{5}Cu3H_2$.

Loc. Probably some of the Gwennap Mines.

Obs. It may be readily distinguished from chrysocolla, which it much resembles, by its hardness and blowpipe reactions; from malachite, by its solubility without effervescence in HNO_3.

COVELLITE.

[Covelline. Indigo Copper.] Hexagonal; with perfect basal cleavage; crystals very rare; usually massive, foliaceous; reniform, investing, pulverulent, or granular; sectile; thin leaves flexible; opaque; lustre submetallic, pearly, or greasy; deep blue; streak black, or dark lead-grey; shining; H. 1·5-2; G. 3·8 to 3·9; crystals 4·6.

B., etc. In matrass gives a sublimate of sulphur; in open tube sulphureous fumes; on C burns with a blue flame and sulphureous odour, and fuses to a globule of copper, which is more perfectly reduced by the addition of a little soda; decomposed by HNO_3, forming a green solution, and leaving a white deposit of sulphur.

Comp. Anhydrous sulphide of copper. No analysis of a British specimen is known, but foreign specimens yield from 32·0 to 34·3 per cent. of sulphur and 64·5 to 66·0 of copper, with usually a little lead or iron. With copper 66·5 and sulphur 33·5 write Cu_2S_2 or CuS.

Loc. Huel Kind, St. Agnes; Huel Maudlin, investing chalcopyrite; Carn Brea, pulverulent; also Vesuvius, Saxony, Poland, Thuringia, &c.

CROMFORDITE.

[Phosgenite. Horn Lead.] Pyramidal; usually in four-sided prisms more or less modified; with three easy cleavages forming angles of 90° 0′ and 135° 0′; brittle or almost sectile; fracture conchoidal; transparent to translucent; lustre adamantine to waxy; white, or greyish, yellowish, greenish, brownish; streak white; H. 2·5-3; G. 6-6·3.

B., etc. In matrass melts and sometimes turns darker while hot; on C melts at 1 to a yellow globule, which becomes white and crystalline on

cooling; in RF gives a bead of lead with white coating of chloride of lead; with a micro. and oxide of copper gives the reaction for chlorine; soluble with effervescence in HNO_3.

Comp. Anhydrous chlorocarbonate of lead. The Cornish specimen has not been analysed, but three specimens from Derbyshire yielded the following results:—

	a.	b.	c.
Carbonate of lead ...	48·4	48·45	48·22
Chloride of lead	53·5	50·93	51·78

a. by Klaproth, b. by Rammelsberg, c. by Smith. With carbonate of lead 49·0 and chloride of lead 51·0, or oxide of lead 81·9, carbonic anhydride 8·1, and chlorine 13·0 the formula may be written $\dot{P}bC + PbCl_2$ or $PbCO_3 + PbCl_2$ or $COPbo''PbCl_2$.

Loc. One specimen only has been found in Cornwall, which is like Fig. 78, its exact locality is believed to be Huel Confidence, Newquay, St. Columb Minor. It occurred in a gozzan. Also Derbyshire and Scotland, Sardinia and Silesia, but very rare. Some crystals from Derbyshire were sold at prices from £15 to £20 each.

Obs. It may be readily distinguished from Cerussite by the reaction for chlorine with oxide of copper, and by the form of the crystals. The cleavages are parallel to O, M, a.

Angles.

M O =	90°	00′	O x =	123°	08′
M M	90	00	O s	112	24
O a	90	00	x x′	113	48
M a	135	00	x x	107	21
M u	161	34	s a	145	47
M x	146	54	s s	131	10
M s	151	26			

CRONSTEDTITE.

[Chloromelane.] Hexagonal; in three or six-sided prisms, vertically striated, and often in radiating aggregations of such prisms, tapering somewhat toward the summit, sometimes in hemihedral or macled forms, like Figs. 219, 236, 237, 238; or reniform; or massive, fibrous, or amorphous; cleavage parallel to O, very perfect, sometimes curved; brittle; thin fibres, somewhat flexible and elastic; translucent to opaque; lustre vitreous, brilliant; black; streak very dark green; H. 2·5-3·5; G. 3·3 to 3·5.

B., etc. In matrass gives off water; on C froths and fumes somewhat on the edges, yielding in the RF a grey or black magnetic globule; with borax gives the reactions for iron and manganese; with soda on Pt. foil the reaction for manganese; decomposed by strong HCl, leaving a deposit of gelatinous silica.

Comp. Hydrous silicate of iron. Two analyses of Cornish specimens, by Professor N. S. Maskelyne and Dr. Flight, yielded the following results:—

	a.	b.
Iron peroxide	36·762	32·752
Iron protoxide	36·307	38·570
Silica	17·468	18·546
Lime	0·087	—
Water	10·087	10·132
Totals	100·711	100·000

With protoxide of iron 41·54, peroxide of iron 30·77, silica 17·31, and water 10·38 the formula may be written $3FeSiO_4 + 4(Fe_2)^{vi}H_6O_6$. A small sample very carefully picked actually yielded 41·272 of iron protoxide.

Loc. Huel Maudlin, Lanlivery, in divergent groups, like Figs. 219, 236, 237, 238, on chalybite and decomposing pyrites, with Hisingerite and Vivianite; also found in Bohemia and Brazil.

Obs. It is one of the rarest British minerals, only a few specimens having been obtained. Some recent observations on the peculiarities of its form, &c., will be found in the Journal of the Chem. Soc. for Jan., 1871, p. 11.

Crosscourse Spar. See Quartz.

Cryptocrystalline. Amorphous.

Crystal. Minerals which occur in geometrical forms are said to be crystallized. Each specimen is a "crystal," twin crystal, or group of crystals. The surfaces are termed "planes," even when curved, rough, or striated. The meeting of two planes produces an "edge;" of three or more planes an "angle."

Crystalline. Made up of small and indistinct crystals.

Crystallography. The science of crystals. The numerous forms of crystals met with in nature are usually referred to six simple types or "systems," depending upon the number, position, and relative lengths of certain imaginary lines called "axes," to which the various planes are referred. Some of the names which these systems have received from various writers are here set down, the first mentioned being the names adopted in this work.

1. CUBICAL.
   Monometric.
   Tessular.
   Isometric.
   Regular.
2. PYRAMIDAL.
   Tetragonal.
   Dimetric.
   Two & one axial.
3. RHOMBIC.
   Prismatic.
   Trimetric.
   Orthotype.
   Orthorhombic.
   One & one axial.
4. OBLIQUE.
   Monoclinohedric.
   Monoclinic.
   Hemiorthotype.
   Two & one mem bered.
5. ANORTHIC.

Triclinohedric.	6. HEXAGONAL.
Triclinic.	Rhombohedral.
Anorthotype.	Three & one axial.
One & one membered.	

1. Cubical. THREE AXES, AT RIGHT ANGLES, EQUAL IN LENGTH; primary form, the octahedron (Fig. 1), or the cube (Fig. 2).

2. Pyramidal. Three axes, at right angles, two equal, one longer or shorter. The unequal axis is called "principal," the other two are "lateral." Primary form, a double pyramid with square base, or a prism with square base.

3. Rhombic. THREE AXES, AT RIGHT ANGLES, ALL UNEQUAL. One is chosen for the "principal," of the remaining axes the longer is termed "macrodiagonal," the shorter "brachydiagonal." Primary form, a double pyramid on rhombic base, or a prism on a rhombic base.

4. Oblique. THREE AXES; TWO INTERSECT EACH OTHER AT AN OBLIQUE ANGLE, AND ARE CROSSED BY THE THIRD AT RIGHT ANGLES; ALL UNEQUAL IN LENGTH. One of the oblique axes is chosen for principal; the one which forms a right angle with this is termed "orthodiagonal," the other lateral axis is "clinodiagonal." Primary form, an oblique double pyramid, or oblique prism.

5. Anorthic. THREE AXES, ALL INCLINED, ALL UNEQUAL. One is chosen for principal, the others are macro and brachydiagonal. Primary form, a doubly oblique double pyramid, or doubly oblique prism.

6. Hexagonal. FOUR AXES; THREE LATERAL, EQUAL IN LENGTH AND LYING IN ONE PLANE, AND MAKING WITH EACH OTHER ANGLES OF 60°, THE FOURTH PRINCIPAL, AT RIGHT ANGLES, AND OF ANY LENGTH. Primary form, a double pyramid on a hexagonal base, or a prism on the same base.

Cube. A solid six-sided figure, the sides equal squares. (Fig. 2.)

Cube Ore. See Pharmacosiderite.

Cupellation. A method of separating the noble metals from lead and other impurities. It may be successfully performed on a small scale as follows:—A hole is made in a piece of charcoal, about one-half of an inch wide and the same in depth. This is filled with slightly moistened bone ash (a bone burnt in an open fire and finely crushed will do very well), and pressed down with some smooth convex surface so as to produce a corresponding smooth concavity. In this hollow the assay, mixed with several times its weight of lead (unless the sample be a lead ore), is placed, and treated with a strong oxidising flame. The lead will become oxidised and sink into the bone ash, carrying any impurities with it, and leaving the noble metal, gold or silver, as the case may be, on the surface. If the operation be well done the bead will be very nearly a perfect sphere. In this way silver may be detected in a few grains of almost any specimen of galena, a magnifying glass being used to detect the bead of silver.

CUPRITE.

[Red Copper Ore. Red Oxide of Copper.] Cubical; in cubes, octahedrons, rhombic dodecahedrons, and other forms (Figs. 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 24, 30, &c.); cleavage parallel to O, perfect; also fibrous, granular, compact, earthy, or disseminated; brittle; fracture conchoidal or uneven; subtranslucent to opaque; submetallic, adamantine, silky; splendant to dull; various shades of red to dark reddish-grey, often with a dark brown tarnish, or sometimes a green coating of carbonate; streak brownish-red, shining, or earthy; H. 3·5-4; G. 5·6-6·2.

Var. Chalcotrichite, capillary red oxide, or plush copper, is a fibrous variety, with silky lustre and very beautiful red colour, which seems made up of elongated cubes.

Tile ore is a massive earthy variety, which often contains a considerable proportion of oxide of iron.

Ruby Copper consists of small and brilliant crystals of a dark red colour.

B., etc. In matrass no change, or becomes darker; on C with a strong flame, RF, is reduced to a bead of Cu; with borax and micro. gives Cu reactions; if moistened with HCl tinges the tip of the flame bright blue; soluble in HCl, HNO_3, and ammonia.

Comp. Anhydrous cuprous oxide. The following analysis of a Cornish specimen is by Chenevix:—

Copper	85·5
Oxygen	11·5
Total	97·0

With copper 88·78 and oxygen 11·22 the formula may be written Cu_2 or Cu_2O.

Loc. Fine specimens of crystallized cuprite have been obtained from Huel Basset, South Huel Basset, South Huel Frances, Huel Buller, Huel Druid, and other mines near Redruth; Huel Music; Dolcoath; Carn Brea; Tincroft; Huel Unity; Huel Gorland; Huel Prosper;

Huel Muttrell; Huel Virgin; Ting Tang; Treskerby; Huel Crenver; Huel Abraham; St. Ives Consols; Huel Edward, Huel Speed, Botallack, and other St. Just mines; Mullion, and other places in the Lizard district; Polgear, Wendron; Fowey Consols; Gunnislake; Phœnix Mines; Carvath United, Calstock; Huel Crebor; Devon Great Consols; Bedford United; and other mines in Devon and Cornwall.

Chalcotrichite has been found at South Huel Frances; West Huel Basset; Huel Unity; Huel Gorland; Owen Vean, St. Hilary; Gunnislake; Phœnix; Fowey Consols; Huel Charlotte, St. Agnes (1825); &c.

Tile Ore occurs in very many of the above-named mines. Cuprite occurs also in France, Spain, Germany, Italy, Siberia, Australia, Cuba, Chili, the United States, &c.

Obs. The figures referred to above are all Cornish or Devonshire forms.

Angles.

o o =	109°	28′	n a =	144°	44′
a a	90	00	n o	160	32
d d	120	00	p o	164	12
o a	125	16	p d	160	32
d a	144	44			

CYANOSITE.

[Chalcanthite. Blue Vitriol.] Anorthic; crystals somewhat like Fig. 183, with an imperfect cleavage parallel to M; also amorphous, stalactitic, reniform, fibrous, pulverulent; brittle; fracture conchoidal or uneven; semitransparent to translucent; lustre vitreous; various shades of blue, or greenish-blue; streak white; H. 2·5; G. 2·2-2·3; taste very nauseous and metallic.

B., etc. In matrass melts very readily at first, gives off large quantities of water and acid vapours with a strong smell of sulphur; finally becomes a nearly white dry mass; on C is readily reduced to a bead of Cu, tinging the flame green; soluble in water, forming a blue solution, which deposits a film of Cu upon clean iron.

Comp. Hydrated cupric sulphate. When pure its composition is nearly—

Oxide of copper	32·00
Sulphuric anhydride	32·00
Water	36·00
Total	100·00

This may be represented by the following formulæ:—$CuS+5H_2$ or $CuSO_4+5H_2O$ or $SO_2Cu''5OH_2$.

Loc. Ting Tang, and other mines in Gwennap, in crystals nearly an inch long, formerly; St. Ives Consols; Trevarthen, near Marazion; Botallack, in the Crown's lode, at 165 fathoms from the surface, fibrous and crystallized; South Frances, and other mines near Redruth; West Huel Jane; Gunnislake, fibrous and massive; also found in Wales, Ireland, Hungary, Germany, Sweden, Spain, Chili, &c.

Obs. It is often found on burrows and in old workings, and is a product of the decomposition of other copper ores. The water from most copper mines has usually some cyanosite in solution. Works for the extraction of the copper have been established from time to time at Carnon, Perranzabuloe, and other places. For this purpose it is only necessary to leave pieces of scrap iron in the cupreous water, when the copper is slowly precipitated upon the iron. Beautiful specimens of precipitated copper are occasionally found on nails and fragments of iron in the old workings of copper mines.

Angles.

O M =	108°	12′	M n =	153°	44′
O T	127	31	M v	126	10
M T	123	10	O v	125	38
M r	126	57			

D.

Dark Red Silver Ore. See Pyrargyrite.

Decomposed. Separated into its elements, or into less complex parts.

Decrepitation. The crackling noise heard when many minerals are suddenly heated. The mineral usually flies to pieces. *Ex.* Blende, Wolfram.

Deltohedron. A regular solid geometrical figure, bounded by 24 equal "deltoids" (Fig. 5). It is a common form for crystals of garnet, and hence is sometimes called the granatohedron.

Deltoid. A plane four-sided figure, such, that one of its diagonals divides it into two equal *scalene*, and the other into two unequal *isosceles* triangles.

DEMIDOFFITE.

Amorphous; earthy; translucent to opaque; surface splendant; sky blue or greenish; streak blue; H. 2; G. 2·25.

B., etc. In matrass turns darker and gives off water; on C alone turns dark; with borax yields a grain of copper; decomposed by acids, depositing silica.

Comp. Hydrated silicate and phosphate of copper.

Loc. It is said to be found in Cornwall (Bristow's Manual of Mineralogy, p. 107); and in Cumberland, in company with quartzose rock and malachite; also Valparaiso.

Obs. It covers some of the malachite of Nischne Tagilsk in delicate layers.

Dendritic. Tree-like, branched. A term applied to the branching forms common in native silver and other minerals.

Desmine. See Stilbite.

Devonite. See Wavellite.

Diallage. See Pyroxene.

DIALLOGITE.

[Carbonate of manganese.] Hexagonal; in small rhombohedrons, drusy aggregates, reniform masses, earthy crusts, or pulverulent; brittle; fracture uneven; opaque or translucent on thin edges; vitreous to pearly; rose-red or brownish, often with a dark tarnish; H. 4-5; G. 3·4-3·6.

B., etc. In matrass turns darker; on C alone infusible; with soda forms a green bead; with micro. or borax gives Mn reactions; soluble with effervescence in warm HCl or HNO_3.

Comp. Anhydrous carbonate of manganese. Church obtained from a Cornish specimen, of a pale rose red colour, and very pure:—

Oxide of manganese	60·29
Oxide of iron	1·65
Carbonic anhydride	38·36
Total	100·30

Pure specimens have the following composition:—

Oxide of manganese	61·76
Carbonic anhydride	38·24

With this composition the formula may be written $\dot{M}n\ddot{C}$ or $MnCO_3$ or $\dot{C}O\dot{M}no''$. The manganese is often partially replaced by magnesia or lime.

Loc. Said to have been found at Bovey Tracey, Botallack, and Huel Owles; also found in Shropshire, Warwickshire, Ireland, Germany, Hungary, Transylvania, Spain, United States, &c.

Diaphaneity. A general term expressing the degree of transparency or opacity of minerals. The several degrees are:—

a. *Transparent.* Outlines can be distinctly seen through such substances.

b. *Semitransparent.* Outlines may be seen, but are indistinct.

c. *Translucent.* Light passes through, but no outline can be seen.

d. *Subtranslucent.* Light is only transmitted through thin edges or splinters.

e. *Opaque.* No light is transmitted.

Dichroic. Minerals which appear to be of *two* different colours by transmitted light, according to the direction in which they are viewed, are said to be dichroic. Those which appear of *three* colours are said to be *trichroic.* Tourmaline is often dichroic, and axinite is trichroic.

Dihedral. Having two planes. A crystal like Fig. 160 is said to be a prism with a dihedral summit.

Dimorphism. This term is used to express the property possessed by some substances (both simple and compound), of crystallizing in forms derived from two distinct sets of crystallographic axes. Thus carbon as diamond is CUBICAL, but as graphite it is HEXAGONAL. A substance which crystallizes in *three* forms is *trimorphous.* Sometimes the term *polymorphous* is used when the substance appears in more than two forms.

The following cases of dimorphism occur in Cornwall or Devon:—

Sulphide of Iron, FeS_2.	Pyrites: CUBIC.
	Marcasite: RHOMBIC.
Carbonate of Lime, $CaCO_3$.	Calcite: HEXAGONAL.
	Aragonite: RHOMBIC.

The following is a case of trimorphism:—

Titanic anhydride, TiO_2.	Rutile: PYRAMIDAL.
	Anatase: PYRAMIDAL.
	Brookite: RHOMBIC.

Disseminated. Sown or scattered. A term applied to minerals, whether crystallized or not, which seem to be scattered in small particles through a mass of another kind of matter.

Divergent. Crystals which diverge from a common point of support are said to be divergent.

Dogtooth Spar. See Calcite.

Dodecahedron. A solid figure, bounded by 12 planes. The chief dodecahedrons are the following:—

a. *Rhombic Dodecahedron* (Fig 3). This is bounded by 12 equal rhombs.

b. *Deltoid Dodecahedron* (Fig. 34). Bounded by twelve equal deltoids.

c. *Trigonal Dodecahedron* (Fig. 35). Bounded by twelve equal triangles.

d. *Pentagonal Dodecahedron* (Fig. 43). Bounded by twelve pentagons.

DOLOMITE.

[Bitter Spar. Brown Spar. Pearl Spar.] Hexagonal; in rhombohedrons, which are often curved; or in other forms resembling those of calcite and chalybite (Figs. 197 and 231); cleavage perfect, parallel to R, but often curved; also massive, granular, or compact; translucent to opaque; lustre vitreous, resinous, or pearly, especially on cleavages; white, yellow, brown, greenish, reddish, black; streak white, or slightly tinged as the colour in coloured varieties; H. 3·5-4; G. 2·8-3·1.

Var. a. Bitter Spar is a variety with a bitter taste.

b. Brown Spar is the name given to dark brown varieties.

c. Pearl Spar includes those varieties which have a pearly lustre.

d. Ankerite is a variety containing a considerable proportion of carbonate of iron.

B., etc. In matrass unchanged; on C alone infusible, but becomes alkaline; when treated with Co the light-coloured varieties turn pink or reddish; the darker varieties often turn brown or black from the presence of iron; slowly soluble in HCl or HNO_3, with but a slight effervescence.

Comp. Anhydrous carbonate of lime and magnesia, with very often some iron or manganese. The mean composition of pure specimens is somewhat as follows:—

Lime	30·34
Magnesia	21·80
Carbonic anhydride	47·86
Total	100·00

With this composition the formula may be written $\dot{C}a\dot{M}g\ddot{C}$ or $CaCO_3+MgCO_3$ or $C_2O_3Cao"Mgo"$.

Loc. Botallack, Huel Castle, Huel Owles, Levant, St. Just Amalgamated, and other St. Just mines, on quartz and brown iron ore; St. Ives; New Rosewarne; Trevascus; North Roskear; West Chiverton; Great South Chiverton; Penhale; Polgooth; Garras; South Hooe; Beerferris; Beeralstone, on fluor; near Kitley Park, rose-coloured; also Cumberland, Yorkshire, Scotland, Germany, Italy, Switzerland, Hungary, Tyrol, Norway, Sweden, the United States, &c.

Obs. It is perhaps only a variety of calcite, rich in magnesia. It seems to pass into chalybite by an increasing proportion of iron. It may be distinguished from calcite by its superior hardness and density.

Angles. Nearly the same as those of calcite.

R R′ = 73° 55′ R′ R′ = 106° 15′

DOMEYKITE.

(Condurrite. Arsenical Copper Pyrites.] Amorphous; massive or disseminate; fracture uneven or flat conchoidal; lustre metallic or dull; tin-white, yellowish, brown, or black; H. 1-3·5; G. 4·5.

Var. Condurrite is a variety which is brownish-black externally, but tin-white or yellowish on a freshly exposed surface. It is so soft as to soil the fingers.

B., etc. In matrass yields usually some water, and a white or yellowish sublimate; on C fuses at 1, giving off arsenical fumes; with soda and borax yields a bead of copper; insoluble in HCl; partially soluble in HNO_3.

Comp. Anhydrous arsenide of copper, the water being only mechanical and in partially decomposed specimens. The analyses of Blyth (a) and Faraday (b) gave as the mean composition of condurrite—

	a.	b.
Arsenic	28·85	29·89
Copper	71·15	70·11
Totals	100·00	100·00

With arsenic 28·7 and copper 71·3, the formula may be written Cu_3As or $AsCu_3$.

Loc. Condurrite has been found from time to time at Condurrow Mine, Camborne; and at Huel Druid, Redruth, in dark coloured, nodular, earthy masses.

Dropstone. A local name for Stalagmites.

Drusy. "Dewy." A surface which appears sprinkled with very small crystals; or the crystals themselves.

E.

Earthy. A mineral, the surface of which when broken is somewhat soft, and presents a multitude of minute prominences without lustre, is said to be *earthy*. An earthy *smell* is that which is yielded by clayey substances when breathed upon.

Earthy Manganese. See Wad.

Effervescence. The peculiar frothy appearance observed when acids are poured upon limestone, and all similar phenomena, are called effervescence. It arises from the rapid disengagement of a multitude of minute bubbles of gas.

Efflorescence. The peculiar powdery appearance produced on crystals of carbonate of soda and other substances when exposed in dry air is so called.

Eisenkiesel. A ferruginous variety of quartz.

Eisennickelkies. See Pentlandite.

Elastic. A mineral which, after being bent, flies back to its original position, is said to be *elastic*; mica is elastic; talc, which often much resembles it, is only *flexible*.

Electricity. One of the *physical characters* of minerals. Some minerals become electric by friction, some by heat, and some by percussion. A very simple electroscope may be made from a bent glass rod, from which a small fragment of gilt paper is suspended by a thread

of silk. On approaching a substance, the electricity of which is excited by the above or any other methods, the suspended fragment will move towards it. Many interesting experiments in electricity may be made by means of this simple instrument. The electricity excited by these simple means is not always of the same kind. Thus, fluor and apatite become *negatively*, wolfram, mispickel, and cassiterite *positively* electrified by friction. The kind of electricity varies, however, in the same mineral, according to the smoothness or roughness of the rubbed surface.

Elements. Substances which have not as yet been decomposed. About sixty-three elements are known to chemists, but the great majority of mineral substances are made up of a few only. The elements most commonly met with in the mineral kingdom are—

Oxygen,	Aluminium,
Hydrogen,	Magnesium,
Nitrogen,	Iron,
Carbon,	Potassium,
Silicon,	Sodium,
Calcium,	Sulphur.

See Part I. of this work for a complete "TABLE OF THE ELEMENTS," with their specific gravities, &c.

Elvan. A Cornish name applied to the porphyritic dykes which intersect most of the mining districts. Many of them are highly felspathic, and some contain disseminated crystals of felspar, quartz, schorl, pinite, and other minerals.

Emerald. See Beryl.

Endellionite. See Bournonite.

EPIDOTE.

Oblique; in modified, often macled prisms; one perfect cleavage, parallel to M (Fig. 159), and one imperfect, making angles of 115° 24′; also columnar, granular, radiating, or massive; brittle; fracture uneven, conchoidal, or splintery; semitransparent to translucent on thin edges; vitreous; pearly on cleavage; green, yellow, red, brown, black, often pleochroic; streak white; H. 6·5; G. 3-3·5.

Var. The epidotes are divided into four groups, as follows:—

a. Lime and iron epidote.
b. Lime epidote.
c. Manganesian epidote.
d. Cerium epidote.

The Cornish specimens are probably of the class a., but no analysis has been made, the mineral being so scarce.

B., etc. In matrass no change; on C fusible to a glass, especially the dark varieties; with borax gives reactions for Fe or Mn; with micro. the same, leaving a skeleton of silica in the bead; insoluble in HCl or HNO_3; after ignition partly soluble, depositing powdery or gelatinous silica.

Comp. Anhydrous silicate of alumina, iron, and lime. No analysis of a Cornish specimen is published, but foreign specimens yield about 38·0 per cent. of silica, 21·0 of alumina, 16·0 of peroxide of iron, and 24·0 per cent. of lime, with traces of magnesia. Sometimes the iron is partly replaced by manganese. With silica 38·1, alumina 21·6, lime 23·5, peroxide of iron 16·8, the formula may be written $\dot{\dot{F}}e_2\ddot{A}l_2\dot{4}Ca\ddot{6}\dot{S}i$ or $4CaO\dot{S}iO_2 + 2\dot{S}iO_2 + 2\ddot{A}l_2O_3 + \dot{\dot{F}}e_2O_3$.

Loc. Crowns' Rock, Botallack, in thin light green radiating groups of crystals, on dark hornblende rock; Mr. J. Carne observes, "Epidote is visible in many other parts of the same cliff, in veins, and has also been found in the tin and copper lodes." (Trans. Roy. Geol. Soc. of Cornwall, vol. ii.); Carn Silver, with Pyrites; Lamorna Cove, at the junction of the granite and slate; Marazion, in quartz; St. Keverne; South Tresavean, in green acicular crystals, &c.; also Cumberland, Wales, Scotland, Ireland, Norway, France, Tyrol, &c.

Obs. The crystals hitherto discovered in Cornwall have not been at all well defined in form; some are not unlike blades of grass, radiating from a centre, and pressed flat to the surface of the rock.

Angles.

M r =	116°	17′	M z =	104°	16′
M l	90	33	r n	125	16
M n	104	49	z z	109	51

The face l is often striated.

Equivalent. That weight of an element which is required to displace one part of hydrogen from a compound, or which one part of hydrogen will displace.

ERINITE.

Crystallization unknown; mammilated, fibrous, concentric; brittle; opaque or subtranslucent; lustre resinous or dull; emerald-green to grass-green; streak apple-green, or paler than colour; H. 4·5-5; G. 4·4.

B., etc. In matrass decrepitates and gives off water; on C fuses, giving off arsenical fumes; with borax yields a bead of copper; soluble in HNO_3.

Comp. Hydrated arseniate of copper. The following analysis is by Turner:—

Arsenic anhydride.....	33·78
Oxide of copper.....	59·44
Alumina	1·77
Water	5·01
Total.....	100·00

With arsenic anhydride 34·7, oxide of copper 59·9, and water 5·4 the formula might be written $\dot{\dot{\dot{A}}}s_2\dot{5}Cu2H_2$ or $CuO_3As_2O_5+2CuH_2O_2$ or $As_2O_3Cuo''_32CuHo_2$.

Loc. It has been found in old Cornish collections by Professor Church.

Obs. It is said by Haidinger to come from the county of Limerick, in Ireland, hence the name. It occurs in mammilated and concentric crusts, with a crystalline fibrous structure, and rough surfaces, which are probably the terminations of minute crystals.

ERUBESCITE.

[Purple Copper. Bornite. Horseflesh Ore. Buntkupferz.] Cubical; usually in cubes modified at the angles (Fig. 9), or macled (Fig. 58); the faces are sometimes curved; also massive; sectile or brittle; fracture imperfect conchoidal or uneven; opaque; lustre metallic; copper-red to bluish or brownish; often an iridescent tarnish; streak greyish-black, shining; *scratch* brownish or purplish; H. 3·3; G. 4·4-4·5.

B., etc. In matrass gives a yellow sublimate; on C melts to a black or dark reddish-brown, magnetic, brittle globule; when roasted and treated with a little borax yields a bead of copper; if moistened with HCl colours the flame blue; soluble in HCl or HNO_3, forming a green solution.

Comp. Anhydrous sulphide of copper and iron. The following are analyses of Cornish specimens, a., a specimen from Condurrow Mine, by Plattner; b., from a mine near Redruth, by Chodnew; both crystallized:—

	a.		b.
Copper	56·76	...	57·89
Iron.....	14·84	...	14·94
Sulphur	28·24	...	26·84
Totals.....	99·84	...	99·67

With copper 62·5, iron 13·8, and sulphur 23·7 the composition would be expressed by the formula $FeCu_2S_3$ or 2CuS, FeS. The iron, however, seems to replace the copper in different proportions.

Loc. Pennance Consols, in crystals like Fig. 58; South Tolgus, Huel Buller, and other mines near Redruth; Carn Brea, Dolcoath, Tincroft, Cook's Kitchen, Condurrow, Camborne Vean, and other mines near Camborne; Tresavean; Huel Jewell; Huel Falmouth; Botallack, Levant, and other St. Just mines; Huel Alfred; Huel Boys; Great St. George; Britannia and Prince Regent, &c.; also Somerset, Ireland, Norway, Siberia, Silesia, Bannat, Hesse, Hungary, &c.

Obs. It may be readily distinguished from grey copper (chalcocite) by its superior hardness and by the form of the crystals; from chalcopyrite by the colour of the *scratch*, which is always yellow in chalcopyrite, but always brownish-purple in erubescite.

Angles.

a a =	90°	00′	o o =	109°	28′
a o	125	16			

ERYTHRITE.

[Erythrine. Cobalt Bloom. Arseniate of Cobalt.] Oblique; in acicular prisms, like Figs. 170, 171; with a perfect cleavage parallel to M; more usually in acicular crystals or radiating groups; or earthy crusts; sectile; thin plates flexible; translucent to opaque; pearly, vitreous, or dull; colour crimson, or other shades of red, usually tinged with blue, often peach-blossom red, occasionally greenish or greyish; streak like the colour, but paler; sometimes the same crystal will be both green and red; H. 1·5-2·5; G. 2·9-3.

B., etc. In matrass gives off water and deposits a white crystalline sublimate; on C melts to a grey brittle globule, depositing a white incrustation at some distance from the assay, and giving off a powerful odour resembling garlic; with borax and micro. a dark blue bead is formed; soluble in HCl and HNO_3, forming a pink solution; turns black if treated with KHO.

Comp. Hydrous arseniate of cobalt; the cobalt often partially replaced by nickel. No analysis of a Cornish specimen is known, but foreign specimens yield from 38·0 to 54·0 per cent. of arsenic anhydride, 18·0 to 36·0 per cent. of oxide of cobalt, and 12·0 to 24·0 per cent. of water. With arsenic anhydride 38·43, oxide of cobalt 37·55, water 24·02, the formula may be written $\dot{\dot{\dot{A}}}s_2\dot{3}Co8H_2$ or $(Co)_3As_2O_5+8H_2O$ or $As_2O_3Co_3''+8OH_2$.

Loc. Botallack, near Crown's Engine, with cobaltite and smaltite; Roscommon cliff, with axinite; Huel Trenoweth; Huel Unity; Dolcoath; Huel Sparnon and East Pool, on smaltite; Pednandrea; Polgooth; Trugoe; Willsworthy Mine, Tavistock; also Cumberland, Germany, Hungary, &c.

Obs. The earthy peach-blossom varieties are often found on ores of cobalt which have been left in damp situations.

Angles.

O T =	124°	51′	T s =	137°	06′
M T	90	00	O n	149	12
T k	155	05	O M	90	00

Erythrite. An old name for a peculiar red variety of felspar.

F.

FAHLERZ.

[Tetrahedrite. Grey Copper. Fahlore.] Cubical; usually in tetrahedrons, more or less modified, like Figs. 33, 35, 38, 39, 40, 41, 42; also massive or disseminated; brittle; fracture conchoidal, uneven, or even; opaque, or very slightly translucent on thin edges; metallic or submetallic; steel grey to iron black; crystals often rough and beautifully iridescent; streak brownish, reddish, or black; H. 3-4; G. 4·5-5·2.

Var. Polytelite, or Freibergite, is a variety containing a notable proportion of silver. Tennantite is, perhaps, an arsenical Fahlerz.

B., etc. In matrass gives a red or reddish-yellow sublimate; on C fuses readily and boils slightly; gives off arsenical vapours and forms a white incrustation on the cool part of the charcoal, and leaves a difficultly fusible magnetic slag; with soda and borax yields with difficulty a bead of copper; decomposed by HCl or HNO_3, forming a green solution and a light coloured deposit.

Comp. Sulpharsenide or sulphantimonide of copper, with variable quantities of silver, iron, zinc, and mercury; the pale varieties contain a large proportion of arsenic usually; the darker varieties more antimony. Of the two following analyses of Cornish specimens a. was by Hemming, from Gwennap, b. by Michell, from Crinnis:—

	a.		b.
Copper	48·40	...	46·00
Arsenic	11·50	...	—
Antimony	—	...	21·00
Iron	14·20	...	17·20
Sulphur	21·80	...	14·00
Silica	5·00	...	—
Silver	—	...	1·80
Total	100·90	...	100·00

The composition is so variable that it is difficult to give formulæ, but with copper 50·2 per cent., iron 17·7, arsenic 11·8, sulphur 20·2, the composition might be written As 2Fe 5Cu 4S, or $Cu_5 Fe_2 S_4 As$; with copper 46·7, iron 16·4, antimony 18·0, sulphur 18·9 it might be written $Cu_5Fe_2 S_4Sb$.

Loc. Crinnis, and other mines near St. Austell, in large iridescent crystals (Figs. 33, 35, 38, 39, 40, 41); Botallack; Levant; Cook's Kitchen, Tincroft, Condurrow, Tresavean, Carharrack, South Huel Basset, and other mines in the neighbourhood of Camborne and Redruth, formerly; Trevaunance, St. Agnes; Huel Prosper; Herodsfoot; Trevascus, Trenance; Old Treburgett, St. Teath (Polytelite), Britannia and Prince Regent, North Molton; Beeralstone; Combemartin; Tavistock, &c.; also Scotland, France, Spain, Italy, Germany, Hungary, Mexico, &c.

Obs. The largest crystals have mostly occurred at Crinnis and other mines near St. Austell. Fahlerz may be distinguished from magnetite and hematite by inferior hardness; from mispickel by its darker colour; from chalcocite (copper glance) by superior hardness and brittleness. The crystals may be distinguished from all other similar minerals except Tennantite by their form. Tennantite is probably only an arsenical variety of fahlerz. Perhaps analysis a. is Tennantite. The Polytelite from Old Treburgett contains a considerable proportion of silver.

Angles.

o o =	70°	32′	o a =	125°	16′
a a	90	00	o d	144	44
o n	160	32	d d	120	00

False Topaz. See Quartz.

Felspar. This term, which is commonly applied to a particular species (Orthoclase), is more properly a name for a group of nearly-related species, differing from each other, however, in chemical composition, crystalline form, and other characters. Dana says, "The felspar group is remarkable for its unity in crystallographic and all physical characters." The felspars are characterized by a sp. gr. below 2·85; H. 6-7, or mostly scratched by a good knife; fusibility 3-5; crystallization oblique or doubly oblique, with two easy and nearly perfect cleavages forming angles of 90°, or nearly 90°. In all, the cleavage planes have pearly lustre, and some varieties of several species exhibit an opalescence, or a play of colours, when viewed in certain directions. They have been supposed to pass into each other by imperceptible degrees, and their chemical composition would seem to favour this view, while the differences of crystalline form are not great enough to forbid the supposition. Dana, however, considers the microscopic investigation of the felspars to be entirely in favour of the distinctness of the species. He remarks that oligoclase and orthoclase are often found

together in granite, obsidian, and trachyte, and yet keep themselves distinct, even to microscopic perfection. This has also been shown, by the Rev. Professor Haughton, to be the case with albite and orthoclase in the granites of Cornwall and of Ireland.

The chief species, according to Dana, are :—

	Cleavages.		O. ratio for $\dot{R}\dot{R}_2\dot{S}i$
Anorthite ...	94° 10′ &	85° 50′	1 . 3 . 4
Labradorite.	93 20	86 40	1 . 3 . 6
Hyalophane	—	—	1 . 3 . 8
Andesite ...	—	—	1 . 3 . 8
Oligoclase ...	93 50	86 10	1 . 3 . 9
Albite	93 36	86 24	1 . 3 . 12
Orthoclase..	90 00	90 00	1 . 3 . 12

The amount of silica increases with the increasing proportion of alkalies, from anorthite, which is usually without any alkali, to albite and orthoclase, with the protoxide bases solely alkaline.

The following table, from Page's Handbook of Geological Terms, exhibits the range of composition of the chief felspars :—

	Sil.	Alum.	Pot.	Soda.	Lime.	Iron
Ortho.	64-70	15-20	7-14	1 -4	1- 3	1-2
Albite.	67-71	14-20	1- 4	7-11	1- 3	0-1
Labrad.	48-55	26-30	0- 1	1- 4	9-12	1-3
Anorth.	43-46	33-37	0- 1	0- 1	10-18	0-1
Oligo.	60-64	18-24	1- 3	2-10	2- 5	0-1

Only albite and orthoclase have, as yet, been found in Cornwall and Devon; these are described under their respective headings.

Some of the foreign felspars are valuable as ornamental stones, while the large deposits of *kaolin* or *china clay*, in Cornwall, Devonshire, and elsewhere, are the results of the decomposition of felspar, of granite, or perhaps other felspathic rocks.

Felspathic. Containing felspar.

Fibrous. A term applied to some minerals which occur in, or readily split into, fine thread-like portions, especially if somewhat elastic. *Ex.* Amianthus, Chalcotrichite, &c. Filamentary and Capillary are terms used with nearly the same meaning.

Fibrous Brown Iron Ore. See Limonite.

Fibrous Gypsum. See Gypsum (Satin Spar).

Fibrous Red Copper Ore. See Cuprite (Chalcotrichite).

Fibrous Tin Ore. See Cassiterite (Wood Tin).

Figure Stone. See Agalmatolite.

Filamentary. See Fibrous.

Flaming. A method of testing some substances with borax or micro. in a bead before the blowpipe by rapidly blowing a strong and a weak blast alternately. This intermittent flame, with some metallic oxides, produces an opaque bead, when the ordinary treatment would give a transparent bead. *Ex.* Oxide of Zinc.

Flexible. Capable of being readily bent.

Flint. See Quartz (Calcedony). Flints, apparently derived from chalk rock, are not uncommon in several parts of Cornwall, as Ludgvan, Breage, and other places near the coast, as well as all around the coast itself on the beach. They occur also on the high ground of the Land's End, and some parts of the Scilly Islands.

Floatstone. A peculiar vesicular variety of quartz found in some of the Cornish mines, and elsewhere.

Fluate of Lime. See Fluor.

FLUELLITE.

Rhombic; in very small pyramids, with their solid angles truncated, like Fig. 89, but without the planes v.; transparent to translucent; lustre vitreous; white; H. 3·0.

Comp. According to Wollaston, it contains fluorine and aluminium, but an analysis is much needed.

Loc. Stenna Gwynn, St. Austell, with Autunite and Tavistockite, on a grey quartz rock. Sometimes incrusting small "vugs."

Obs. It was discovered by Levy nearly 60 years ago, but has since been re-discovered by Mr. R. Talling, of Lostwithiel. Most of the specimens yet discovered are in the British Museum, and it is intended soon to make a new analysis. The largest crystals are less than one-tenth of an inch long.

Angles.

e O = 108° 00′ e e′ = 144° 00′
e e 109 04

FLUOR.

[Fluor Spar. Cann. Blue John.] Cubical; in cubes, octahedrons, and most of the forms from Fig. 1 to Fig. 32, also Figs. 53, 55, 58; with perfect octahedral cleavage; also compact, nodular, granular, fibrous, or earthy; brittle; fracture conchoidal or uneven, but difficult to obtain in crystallized specimens; transparent to opaque; vitreous, splendant to glimmering; colourless, white, blue, green, yellow, brown, purple, red, black; sometimes dichroic; or coloured in layers, parallel to the faces of the simple crystal; exhibits fluorescence

in a marked degree; streak white or slightly tinted as the colour; H. 4; G. 3·3·2; pyro or frictio-phosphoric.

Var. Chlorophane is a compact, white, yellowish, or bluish variety, which is highly pyro-phosphoric, shining with a beautiful green light when moderately heated, especially if newly raised.

B., etc. In matrass often decrepitates, sometimes changes colour, or phosphoresces; on C decrepitates, melts to an opaque white crystalline mass, colouring the flame dull red; with gypsum melts to a transparent bead which is opaque on cooling; slowly soluble in HCl or HNO_3, giving off a gas (HF) which corrodes glass; readily decomposed by warm H_2SO_4, giving off HF abundantly, and being converted into sulphate of lime.

Comp. Anhydrous fluoride of calcium. No analysis of a British specimen is known to the writer, but the usual composition is about 47 per cent. of fluorine and 53 per cent. of calcium, which would be represented by the formula CaF_2.

Loc. Huel Spearn, Balleswidden, Spearn Moor, and other St. Just mines, but very scarce; St. Michael's Mount; Tremearne, in granite veins; and Great Huel Vor, Breage, but very scarce; Stray Park, Dolcoath, North Roskear, and other Camborne mines; East Huel Crofty, Carn Brea, East Pool (crystallized and amorphous "chlorophane," associated with wolfram), and other mines in Illogan; South Huel Buller, Cardrew Downs, Pednandrea (crystallized, in many colours, and amorphous "chlorophane"), North Huel Grambler (Figs. 1, 7, 9, 21, 23), Huel Sparnon, Huel Damsel, Huel Gorland, Huel Unity, Huel Unity Wood, and other mines in Redruth and Gwennap, in great variety of colour and form, also fibrous, concentric, or earthy; North Downs; Trevaunance, Huel Devonshire, and other St. Agnes mines, formerly in beautiful octahedrons made up of minute cubes, or in cubes with their edges modified by one, two, or three planes, and other forms, like Figs. 1, 7, 21, 22, 23, &c.; Huel Mary Ann (fine blue modified cubes, like Figs. 10, 21, 23, &c.), Huel Trehane, and Huel Trelawny (deep blue bevelled cubes, like Figs. 18, 21, 22, 23, &c.), Menheniot; Huel Maudlin, near Lostwithiel, in large semi-transparent octahedrons, with chlorite and calcedony; South Caradon and West Caradon, St. Cleer, in colourless elongated cubes, and like Figs. 1 and 2; Stenna Gwynn; Holmbush; Huel Franco, Buckland Monachorum; Virtuous Lady, and other mines near Tavistock; East Tamar Mine; Beeralstone (Figs. 1, 2, 8, 9, 16, 20, 21, 22, 23, 53, 55, &c.) "The finest crystals are either colourless, or of a pale sea-green internally, and upon the surface, or only the edges, of a rich smalt-blue, or a contrary disposition of the same colours" (Greg and Lettsom, p. 24); also pale-green, translucent, or white and opaque octahedrons on hornstone; also fibrous and compact, Fig. 53 shews part of a magnificent crystal from this locality which was in the collection of Professor Phillips. It is probably the most complete crystal of any mineral yet discovered. The foreign localities of fluor are almost everywhere where tin, copper, or lead is mined.

Obs. Fluor occurs massive in most of the copper mines and many of the tin and lead mines of the county, but is somewhat scarce in the extreme west. It occurs also in pseudomorphs at several localities (see Pseudomorphs). It is used as a flux in reducing iron and copper ores, hence its name from "fluo" to flow. "Cann," or "Kann," is a Cornish name; Blue John a Derbyshire name. Chlorophane has, as yet, been found only at East Pool and Pednandrea mines.

Angles.

o o′	= 109°	28′	w a	= 155	42
a a	90	00	w o	145	46
o a	125	16	x x′	166	57
d d	120	00	x x″	140	09
d a	135	00	x a	152	04
f a	161	34	t t″	144	03
f f	126	52	t t′	162	15
m m	120	31	t a	150	48
m a	154	46	a g	147	00
w w′	167	47	a i	174	40
w w″	136	47	y y	177	00

Fluorescence. "This name has been given to the peculiar phenomenon exhibited by fluor spar, of transmitting one colour and reflecting another from a thin layer adjacent to the surface by which the light enters." (Bristow's Gloss. of Min., p. xvi.)

Fluorine. This element, occurs in only a very few minerals, of which fluor is the chief. It may be readily detected in the following manner:—Heat a small portion of the assay, in fine powder, in a clean and dry matrass, and insert in the open end a small slip of Brazil-wood paper. If any fluorine be present the tube will be roughened and rendered opaque inside, and the paper will turn straw yellow. Other delicate tests are described in works devoted to blowpipe analysis.

Flux. A substance added to a mineral to increase its fusibility, and sometimes to carry off one or more ingredients. The principal fluxes used in determinative mineralogy are carbonate of soda (soda), borax, microcosmic salt (micro.), fluor spar, cyanide of potassium, and boric acid.

Foliated. A term applied to minerals which may be split into thin leaves. *Ex.* Mica.

Foliated Arseniate of Copper. See Chaloophyllite.

Form. Minerals which occur in definite geometrical forms are said to be *crystallized* (see Crystallography). Those which are evidently made up of minute or imperfect crystals, the form of which cannot be made out, are said to be *crystalline.* A considerable number of minerals are not known in the crystallized or crystalline state: these are said to be *amorphous.* Many amorphous minerals, as well as some that are known as crystals, occur sometimes in *imitative* forms. The chief of these are:—

a. *Globular.* When the shape is spherical, or nearly so, as in some varieties of aragonite. When the spheres are small we have the *pisolitic* form; when very small, the *oolitic.*
b. *Botryoidal.* When the shape is nearly like that of a bunch of grapes. *Ex.* Malachite.
c. *Mammillary.* In rounded prominences, less separated from each other than in b. *Ex.* Blistered Copper.
d. *Reniform.* A form somewhat like that of a bullock's kidney. *Ex.* Some forms of iron pyrites. *Nodular* is nearly the same.
e. *Stalactitic.* Icicle shaped. *Ex.* Stalactite.
f. *Coralloidal.* In form somewhat like masses of coral. *Ex* Some forms of aragonite (flos-ferri).
g. *Acicular.* Needle-shaped. This is more often seen in distinctly crystallized specimens. *Ex.* Antimonite.
h. *Wiry. Ex.* Native Silver.
i. *Dendritic. Mossy. Ex.* Native Copper.
j. *Leafy.* In thin plates. *Ex.* Native Copper.

Formula. An abbreviated expression of the chemical constitution of bodies, in which the different elements present are represented by their symbols. An *empirical* formula states only the number of atoms of each element present. A "constitutional" or "rational" formula attempts to express something of the arrangement of those elements. Thus $As_2Co_3H_{16}O_{16}$ is an *empirical* formula for Erythrite (Erythrine), while $\dot{A}s_2\dot{3}Co8H_2$ or $(CO)_3As_2O_5+8H_2O$ or $As_2O_5Co''_3+8OH_2$ are *rational* or *constitutional* formulæ for the same mineral.

Fracture. A term used for indicating the kind of surface obtained by breaking minerals. The chief varieties of fracture are:—

a. *Conchoidal.* Shell-like, with the broken surface shewing curved concavities somewhat like those on the inside of a cockle shell. *Ex.* Flint.
b. *Splintery. Ex.* Serpentine.
c. *Hackly.* The broken surface shewing a number of wire-like points. *Ex.* Native Copper.
d. *Uneven. Ex.* Pyrites.
e. *Even.* The specimen breaks with an even surface. It is distinguished from *Cleavage* by the fracture occurring indifferently in any direction, while cleavages are in certain definite directions.
f. *Earthy.* This character may occur in combination with others. It is used when the broken surface is seen to be covered with minute irregularities without lustre. *Ex.* Chalk.

Either of these terms may be qualified by the prefix *sub.* Thus, sub-conchoidal indicates an imperfect conchoidal fracture. *Fracture* must not be confounded with *Cleavage*, as many minerals exhibit both. In some minerals the cleavage is very perfect and easily obtained, while the fracture is scarcely to be at all observed. *Ex.* Mica, Blende, Galena, Calcite, &c.

Francolite. See Apatite.

Frangibility. A convenient term for including such characters as—

a. *Brittle.* When parts of the mineral separate in powder on attempting to cut it. *Ex.* Calcite.
b. *Sectile.* When thin pieces may be cut off with a knife, but the mineral pulverizes under the hammer. *Ex.* Chalcocite.
c. *Malleable.* When slices may be cut off, and these slices may be flattened under the hammer. *Ex.* Native Copper.
d. *Flexible.* When the mineral will bend, and remain bent after the bending force is removed. *Ex.* Native Copper.
e. *Elastic* When the mineral, after being bent, will spring back to its original position. *Ex.* Mica.

f. *Friable.* Crumbling; easily crushed between the fingers. *Pulverulent* has nearly the same meaning. *Ex.* Melaconite.

The term *Tenacity* is sometimes used in the sense of Frangibility.

Freibergite. See Fahlerz (Polytelite).

French Chalk. See Steatite.

Frictio-electric. Minerals which become electric, by rubbing are said to be "frictio-electric." Some are "positively" and some "negatively" electrified by friction. *Ex.* Tourmaline.

Frictio-phosphoric. Minerals which shine with a peculiar light somewhat like phosphorus when rubbed are said to be "frictio-phosphoric." *Ex.* Some varieties of Quarts.

Fuller's Earth. This is said, by Garby, to have occurred in Cornwall, but no locality is given.

Fusible. Capable of being melted. Minerals which cannot be melted before the blowpipe are said to be "infusible."

Fusibility, Scale of. The following is Plattner's scale, which is adopted in this work:—

1. Readily fusible to a bead.
2. With difficulty fusible to a bead.
3. Readily fusible on thin edges.
4. With difficulty fusible on the edges.
5. Infusible.

The following is Von Kobell's scale, which is more definite, but not so easily obtained:—

1. Antimonite.
2. Natrolite.
3. Almandine or precious Garnet.
4. Actinolite.
5. Adularia.
6. Bronzite.

G.

GALENA.

[Lead Glance. Galenite. Sulphuret of Lead.] Cubical; in cubes, commonly modified by planes of the octahedron and rhombic dodecahedron (Figs. 1, 9, 10, 11, 12, 13, 14, 15, 16, 18, 24, 29, 57, 58, and other forms), with perfect cleavage parallel to a.; also massive, concentric, botryoidal, incrusting, disseminated; drusy, granular, or compact; brittle or sub-sectile; fracture uneven, but not easily obtained in crystallized specimens; opaque; lustre metallic, often splendant; lead grey to black; sometimes with an iridescent tarnish; streak black; H. 2·5; G. 7·2-7·7.

Var. Specular galena is a very bright curved lamellar variety. Blue lead is a pseudomorphous variety, after Pyromorphite, which occurred at Huel Hope in 1822 and 1825, in hexagonal crystals; it will burn in the flame of a candle when newly raised. Argentiferous Galena, or Silver Lead, is a name applied to varieties containing a notable quantity of silver.

B., etc. In matrass usually decrepitates, and yields a light coloured sublimate with a strong heat; in the open tube a white sublimate of sulphate of lead, and sulphureous odour; on C sometimes decrepitates, melts readily, and is easily reduced in KF to a malleable bead of lead, giving off SO_3, and depositing a yellow incrustation on the charcoal. A minute grain of silver is often yielded by cupellation; decomposed by HCl, if in fine powder; more easily by HNO_3.

Comp. Anhydrous sulphide of lead, usually with some iron, and sometimes small quantities of antimony, zinc, copper, silver, &c. With lead 86·55 per cent. and sulphur 13·45 the formula may be written $\dot{P}b\ddot{S}$ or $\dot{P}bS\ddot{O}_4$ or $\ddot{S}O_3\dot{P}bo''$.

Loc. West Huel Darlington, Ludgvan, associated with silver ore and native silver; Huel Alfred (with the finest crystals of Pyromorphite ever found in Cornwall), and Boiling Well, Phillack; Binner Downs; Huel Pool, Huel Rose, Huel Penrose, Sithney, with phosphate and arseniate of lead; West Godolphin, Breage; St. Michael's Mount, in small spots; Huel Unity, Gwennap, with very fine crystals of arseniate of lead; Poldice, Tresavean; Trevascus; Huel Basset; Dolcoath; North Roskear; Huel Crofty; Great Huel Baddern, East Huel Falmouth, Huel Jane, and other mines in Kea and Kenwyn; Garras and South Garras, St. Allen; Budock Vean, Swanpool, and other mines near Falmouth; Huel Rose, East Huel Rose, Cargoll, South Cargoll, Newlyn; Huel Golden, Huel Penhale, Trebisker Green (with native silver and silver ore), and other mines in Cubert; West Chiverton; Great South Chiverton; North Chiverton; Perran Huel Virgin; Huel Mexico; Huel Kayle; Carclaze Tin Mine, in small specks; Pentire Glaze (with very fine carbonate of lead), Endellion; Treburgett, St. Teath; Huel Ludcott (with silver ore and native silver), and Huel Wrey, St. Ive; Herodsfoot, St. Pinnock; Huel Mary Ann, Huel Trehane, Huel Trelawny, and other mines in Menheniot; Redmoor; Holmbush; Huel Langford and Huel Brothers, Calstock.

Huel Lee; Huel Tamar; East Huel Tamar; North Huel Tamar; Landkey; Beeralstone; Hennock; Combemartin; Berry Narbor; Devon and Courtenay; Huel

Betsy; Huel Friendship; Bridford; Okehampton Consols, Holestock, and many other localities in Cornwall and Devon. Most metalliferous mines in Cornwall and Devon have yielded small specks of lead, but in the majority of the cases above referred to considerable quantities of lead ore have been raised.

Argentiferous galena has occurred at the following mines, as well as others:—

	Oz. of silver to the ton of ore.	
Beeralstone	80 to 120	
South Hoo, a part of the same mine	140	
Huel Betsy, Tavistock (about).....	12	
Huel Pool, Helston	60	about 1822
Garras Mine, near Truro.....	70	,,
Huel Rose, Newlyn	60 to 65	,,
Swanpool, near Falmouth	Very variable.	

Obs. Galena occurs in almost every mining district where tin or copper is raised, but is, perhaps, *most* abundant in connection with limestone rocks.

The lead ores raised in the two counties during the year 1869—mostly galena—amounted to 10,104 tons, which yielded 343,151 ounces of silver, or an average of nearly 34 ounces per ton. This is by far the richest raised in the United Kingdom, except that of the Isle of Man, where the average is more than 40 ounces per ton. (See Min. Stat. for Great Britain, 1869, by Robert Hunt, F.R.S.)

Galena occurs in veins and beds or irregular deposits, associated with pyrites, blende, limonite, chalcopyrite, calamine, quartz, barytes, and calcite, and ores of gold, silver, arsenic, &c.

It may be distinguished from argentite by its perfect cleavage and brittleness; from graphite and molybdenite by its fusibility; from dark varieties of blende by its dark streak and inferior hardness.

Angles.

o o =	109°	28′	n n =	120°	31′
a a	90	00	n a	144	44
d d	120	00	n o	160	32
o a	125	16	m o	150	30
o d	144	44	m a	154	46
a d	135	00			

Galmei. See Calamine.

Gangue. The rocky material in which a mineral is embedded is called the gangue, or veinstone. Thus, the ordinary gangue of cassiterite is "capel," a hard compound of quartz, chlorite, and oxide of iron.

GARNET.

[Almandine. Colophonite. Melanite; &c.] Cubical; usually in rhombic dodecahedrons (Fig. 3), or in deltohedrons (Fig. 5), but often variously modified, as in Figs. 25, 26, 31, &c.; one of the axes is often lengthened or shortened so as to distort the form; sometimes macled; the faces sometimes curved; also massive, compact, granular, lamellar; very rarely a distinct dodecahedral cleavage; usually tough, but massive varieties sometimes friable; fracture conchoidal or uneven; transparent to opaque; vitreous or resinous; sometimes white, but more usually various shades of red, yellow, green, brown, or black; streak uncoloured, except in impure and partially decomposed specimens; H. 6·5-7·5; G. 3·1-4·3.

Var. The garnets are variously subdivided, according to their chemical composition and colour, as follows:—

a. Grossularite. A lime-alumina garnet, of a light greenish colour.
b. Pyrope. A magnesia-alumina garnet.
c. Almandite, or Precious Garnet. An iron-alumina garnet of a beautiful red colour.
d. Common Garnet. An impure variety of the foregoing, of a brownish colour.
e. Colophonite. A lime-iron-alumina garnet, of a yellowish colour.
f. Spessartite. A manganese-alumina garnet.
g. Aplome. A lime-iron-alumina garnet, from Sweden.
h. Andradite. A lime-iron garnet.
i. Bredbergite. A lime-magnesia-alumina garnet.
j. Ouvarovite. A lime-chrome garnet, of an emerald-green colour.
k. Essonite. A lime-alumina garnet, of a reddish-yellow colour.
l. Melanite. A lime-iron garnet, of a black colour, &c.

The specimens hitherto found in Cornwall and Devon appear to be all either common garnet or colophonite.

B., etc. In matrass unchanged; on C the varieties containing much iron fuse at from 3 to 5 to a dark magnetic bead; with borax or micro. gives the reactions for iron; the powder is slowly decomposed by HCl more readily after fusion, depositing gelatinous silica.

Comp. It is a complex anhydrous silicate of various bases. The range of composition in the various sub-species is very great, viz.:—

Silica	from 37·0	to	43·0
Alumina	0·0		24·0
Peroxide of iron	0·0		31·3
Protoxide of iron	0·0		39·6
Lime	0·0		37·1
Magnesia	0·0		15·0
Oxide of manganese	0·0		31·0
Peroxide of chromium.	0·0		24·0

No analysis of a specimen from Cornwall or Devonshire is known to the writer.

Loc. Huel Cock Carn, Botallack, Crown's Rock, Chycornish Carn, and Roscommon Cliff (Figs. 3, 5, 25, 26, 31), from 1-16th to one inch across, in the hornblende slate of the district, both crystallized and massive; near Lewellin, embedded in carbonate of lime; Cape Cornwall Mine, in a tin capel (Fig. 5) and macled, recently from 1-10th to 1-3rd of an inch; Rose Moddress, a little west of Lamorna Cove, on a junction of granite and slate; St. Michael's Mount; Huel Trannack; in greenstone between Camborne and Tuckingmill, near Dolcoath and North Roskear; Carharrack; near Copper Hill Mine, Redruth, with dark green epidote, very recently; Seal Hole Tin Mine, St. Agnes (Fig. 3); near Lanlivery and Lostwithiel (black, crystallized, and massive, with magnetite), specimens from this locality are now in the Museum of the Royal Institution of Cornwall; Maudlin; Terrace Hill Quarry, near Callington; Lustleigh; Hay Tor; Brent Tor; on Dartmoor, in granite; Belstone Consols, in large crystals, partly decomposed, &c.; also Cumberland, Ireland, Scotland.

Obs. The Cornish garnets are associated mostly with greenstone, either in the rock itself, or in close proximity to it. Most of them are of a dull brown colour, and semi-transparent to nearly opaque; some of the St. Just garnets formerly raised were of a light colour and resinous appearance. (Colophonite?)

Angles.

d d =	120° 00′	n n′ =	131° 48′
n n	146 27	d n	150 00

Gems. These are such mineral specimens as are hard enough and have sufficient beauty of colour to be used as ornaments for the person. Fine specimens of Garnet, Beryl, Topaz, Tourmaline, and Quartz (rock crystals) are used for this purpose. With the exception of the rock crystals, or Cornish diamonds, few specimens of these minerals have been found in the two counties sufficiently good to be so used.

Geodes. These are hollow stone balls, with the inner surface usually lined with crystals, some being occasionally detached. Very fine crystals are sometimes found so situated. Thus, some geodes of partially decomposed galena from Beerferris were found to contain fine crystals of anglesite.

GILBERTITE.

[Margarodite. Talcite. Nacrite. Hydrous Muscovite.] Oblique (?), or more probably Rhombic; usually in compactly aggregated scales; friable; translucent to opaque; lustre pearly; white, grey, yellowish, greenish; H. 2·2·5; G. 2·6·2·8.

B., etc. In matrass gives off water; on C alone becomes silvery white and opaque, but retains its lustre; scarcely soluble in HCl or HNO_3; more readily soluble in H_2SO_4.

Comp. A hydrated silicate of alumina, containing small proportions of other bases. The following analyses of Cornish specimens indicate its composition; a. by Lehunt, a whitish silky specimen, from a lode at Stenna Gwynn, St. Austell; b. by Thomson, ditto:—

	a.		b.
Silica	45·15	...	47·80
Alumina	40·11	...	32·62
Magnesia	1·90	...	1·60
Lime	4·17	...	—
Soda	—	...	9·23
Protoxide of iron	2·43	...	5·18
Water	4·25	...	4·00
Totals	98·01	...	100·43

Loc. Stenna Gwynn, St. Austell, with fluor; Carclaze Tin Mine; Tregoninghill and Tremearne, Breage, &c.

Obs. It is often spoken of as a variety, species, or sub-species of mica. It may, perhaps, be considered the crystalline form of Kaolin. It is associated with the so-called china stone of Cornwall.

Girasol. See Quartz.

Glance Cobalt. See Cobaltite.

Glance Copper. See Chalcocite.

GLAUCONITE.

[Green-earth. Kirwanite.] Amorphous, botryoidal, or massive; earthy; brittle, almost friable; opaque; dull or glimmering; various shades of green, bluish, or greyish; streak somewhat lighter than the colour; H. 0-2; G. 2·2-2·4.

B., etc. In matrass yields much water and darkens; on C fuses easily to a dark magnetic glass; partially soluble in HCl.

Comp. Hydrated silicate of alumina and iron, with often some potash or soda. No analysis of an English specimen is known, but foreign specimens contain from 40·0 to 52·0 per cent. of silica, 5·0 to 12·0 per cent. of alumina, 20·0 to 25·0

per cent. of oxide of iron, 0·0 to 12·0 per cent. of potash, and 4·0 to 10·0 per cent. of water.

Loc. Huel Coates (botryoidal); Branscomb cliff; near Chard; near Beer; and generally throughout the *greensand* of Devon. Also in many foreign localities.

Obs. The term is applied very loosely to substances of very different composition. Probably some of the so-called "green earth" is chlorite. The true Glauconite analysed by Thomson was from New Jersey, and contained 19·0 per cent. of lime.

Glaucosiderite. An old name applied to various kinds of Mica, and also to micaceous Vivianite.

Glimmer. An old name for the various micas.

GOETHITE.

[Hydrous Oxide of Iron.] Rhombic; in tabular crystals, like Figs. 124, 126, with some planes striated; perfect cleavage parallel to a (brachydiagonal); also acicular, capillary, or micaceous; sometimes botryoidal, fibrous, columnar, radiated, granular; fracture conchoidal or uneven; translucent on thin edges; lustre sub-metallic; adamantine, or silky; yellowish, reddish, or blackish-brown; thin plates and fine needles red by transmitted light; streak yellowish-brown; H. 5-5·5; G. 4·1-4·4.

B., etc. In matrass gives off water; on C, in O F turns reddish, R F becomes black and magnetic; infusible, or fusible with great difficulty on thin edges; with borax and micro. gives Fe reactions; soluble in HCl, forming a yellowish solution; often leaves a slight insoluble residue of silica.

Comp. Hydrated peroxide of iron. The following is an analysis by Yorke of a specimen from near Lostwithiel, the sp. gr. of which was 4·37:—

Peroxide of iron	89·55
Oxide of manganese	0·16
Silica	0·28
Water	10·07
Total	100·06

With 90·0 per cent. of peroxide of iron and 10·0 per cent. of water the formula may be written Fe_2H_2 or $Fe_2O_3Ho_3$,

Loc. Botallack, and other St. Just mines, like Fig. 124, and in doubly pointed flattened prisms, with some of the faces striated, rough, or mammilated; Tincroft; Carn Brea; Huel Druid; Huel Beauchamp; Huel Buller; Restormel, in geodes (Figs. 124, 126, and other forms); Tintagel; Delabole; Exmoor, &c.; also in Somerset, Scotland, Germany, Russia, and many other foreign localities.

Obs. It usually occurs in veins and cavities, with quartz and limonite, of which it is, *perhaps*, a crystallized variety. It may be distinguished from specular iron (hematite) and magnetite by its yellowish streak, and by yielding water when heated in a matrass; from rutile and brookite by its blowpipe reactions.

Angles.

M M′ = 94° 52′ k k = 144° 00′
d d′ 130 40 a b 90 00

The form a d M p s has occurred at Botallack; the forms a d p, a d m p d M p s, d M p, a d M p e u r, d M p b, a d M p e, a d M p s, a d M p e s, a d M p e s l z, &c., are from Restormel; some were not less than two inches long.

GOLD.

[Native Gold.] Cubical, in cubes, octahedrons, rhombic dodecahedrons, &c.; or usually in waterworn "nuggets" or scales; also capillary, arborescent, disseminated; malleable; fracture hackly; opaque; lustre metallic; various shades of yellow; streak yellowish and shining; H. 2·5-3; G. 14·5-19·5.

B., etc. In matrass unchanged, or gives a slight sublimate when Tellurium is present; on C fuses easily to a bead but is not otherwise changed; insoluble in HCl or HNO_3, but soluble in Aqua Regia, forming a yellow solution.

Comp. Gold, containing variable proportions of other metals, as Ag, Te, Pd, Rh, Bi, Cu, Fe, &c. The following recent analysis of a specimen from St. Austell Moor is by Mr. D. Forbes, F.R.S., the sp. gr. of which was 16·5:—

Gold	90·12
Silver	9·05
Silica and oxide of iron...	0·83
Total	100·00

Loc. Carnon Valley, in stream tin works. "There is a piece of gold in a matrix of quartz from Carnon vale, in the Royal Institution of Cornwall, weighing 11dwts. 6grs." (A Manual of Mineralogy, Truro, 1825) This piece is said to have been obtained in 1726. The largest specimen ever obtained in Cornwall weighed more than eight guineas. Trewordа, Kenwyn; Probus; Ladock; St. Stephens; St. Mewan; St. Austell Moor, and most of the tin stream works of Cornwall and Devon, formerly, in small quantities; in a crosscourse at Huel Sparnon, Redruth; in gozzan at Nangiles Mines, Kea; in veins at North Molton

and North Tawton, Devon. Traces are often found in galena, pyrites, chalcopyrite, and other ores. Gold occurs in almost every foreign mining district, but especially in Australia, California, British Columbia, the Ural, Transylvania, &c.

Obs. British gold very rarely exhibits any crystalline face. It may be easily distinguished from any mineral thought to resemble it by its sp. gr. and blowpipe characters, as well as its malleability.

Goniometer. An instrument for measuring the angles of crystals. Two kinds are used by mineralogists: the *contact* and the *reflective* goniometer. A very effective contact goniometer for rough measurements of the angles between cleavage planes, &c, may be made by fastening two straight slips of metal together so that they work stiffly on a pivot. The crystal to be measured is placed in the angle, and the two slips adjusted as accurately as possible. The angle may be read off by the aid of a sector, or a common semi-circular protractor. The reflective goniometer is an elaborate instrument. Its construction and use is described in most general works on mineralogy.

GOSLARITE.

[White Vitriol. Zinc Vitriol.] Rhombic; in prisms, with perfect brachydiagonal cleavage, usually acicular; or massive, stalactitic, botryoidal, reniform, investing, pulverulent; brittle; fracture conchoidal or uneven; transparent to translucent; lustre vitreous; colourless, white, or tinged red, green, or blue, from the presence of traces of cobalt, iron, or copper; streak white; H. 2-2·5; G. 1·9-2·1.

B., etc. In matrass melts at first; then gives off a large quantity of water which has an acid reaction; leaves at last a white or grey infusible residue, which is yellow while hot; on C the same as in matrass, but deposits a white incrustation if the R F be used; the white infusible residue treated with cobalt turns green; easily soluble in water; the solution has a very nauseous taste.

Comp. Hydrated sulphate of zinc. The following analysis of a Cornish specimen is by Schaub:—

Sulphuric anhydride	21·64
Oxide of zinc	25·66
Lime	1·00
Oxide of iron	0·17
Oxide of manganese	4·33
Silica	0·67
Water	46·50
Total	99·97

With sulphuric anhydride 27·87, oxide of zinc 28·44, and water 43·89 the formula might be written $\dot{Z}n\dddot{S}+7H_2$ or $Zn\,SO_4+7H_2O$ or $SO_2Zno''_2+7OH_2$.

Loc. Formerly in acicular crystals in a lode traversing the Tresavean and Trethallan Mines, Gwennap, with quartz and blende; the cliffs under Huel Castle, St. Just, with pearl spar and blende; found also in Wales, Germany, Hungary, Sweden, France, Spain, &c.

Obs. It is usually found in old mine workings, and is probably derived from the decomposition of blende. Large quantities are artificially produced for use in dyeing.

Gossan. A miner's term for the loose mixture of Quartz, Oxide of iron, and other minerals often found on the "back" of a lode.

Granite. A rock composed of Quartz, Felspar, and Mica. The Cornish and Devonshire granites often contain crystals of black Tourmaline (schorl), and sometimes of Cassiterite, Beryl, Topaz, and other minerals. For a detailed description of these minerals see under their names.

Granular. Made up of small grains. *Ex.* Chalk.

GRAPHITE.

[Plumbago. Black Lead.] Hexagonal; in flat six-sided tables, like Fig. 223, the plane o striated parallel to alternate edges; cleavage parallel to o perfect; more commonly massive, reniform, fibrous, foliated, granular, compact, scaly, or disseminated; sectile, thin plates or fibres flexible; fracture uneven; very unctuous to the touch; opaque; lustre metallic; dark steel grey; streak greyish-black and shining; soft enough to mark paper and soil the fingers; H. 1-2; G. 1·8-2; it is a perfect conductor of electricity.

B., etc. In matrass unchanged; on C infusible, burns away slowly without flame or smoke; usually leaves a very little reddish ash, which with micro. or borax gives Fe or Mn reactions; insoluble in HCl, HNO_3, or H_2SO_4.

Comp. The purest varieties are almost chemically pure carbon.

Loc. Grampound; Boscastle; Kerjiliack, near Penryn, in an elvan quarry; Tuckingmill, in small lumps, in an elvan course; found also in Cumberland, Ireland, Scotland, and many foreign localities.

Obs. It may be distinguished from Molybdenite by its insolubility in a bead of micro.; also by its streak on porcelain,

which is nearly black, but that of Molybdenite is greenish. It may be easily distinguished from Pyrolusite by its unctuous feel, and from Antimonite and Jamesonite by its infusibility.

Angles.

a a = 120° 00′ a o = 90° 00′

Greasy. A variety of "lustre," well seen in some varieties of serpentine.

Green Carbonate of Copper. See Malachite.

Green Lead Ore. See Mimetite and Pyromorphite.

Green Vitriol. See Melanterite.

Grey Antimony. See Antimonite.

Grey Cobalt. See Smaltite.

Grey Copper. See Chalcocite and Fahlerz.

Grey Manganese. See Manganite.

Grey Oxide of Manganese. See Manganite.

GYPSUM.

[Sulphate of Lime, Selenite, &c.] Oblique; often macled; in tabular or acicular crystals, with perfect clinodiagonal cleavage; also compact, granular or massive; tough; transparent to nearly opaque; lustre vitreous, pearly, or silky; colourless, or white, yellow, brown, &c.; streak white, or much lighter than the colour; H. 1·5-2; G. 2·3-2·4.

Var. Selenite is the name given to crystallized specimens.

Fibrous Gypsum or Satin Spar is a fibrous variety; the same name is given to a fibrous variety of carbonate of lime.

Alabaster is a massive, compact, or granular variety, which often forms rock masses of great extent.

B., etc. In matrass gives off water, and becomes opaque if not previously so; on C fuses with difficulty; with fluor spar fuses easily to an opaline bead; the powder, after heating, if mixed with water to a paste, "sets" to a hard mass; slightly soluble in water; almost insoluble in acids.

Comp. Hydrated sulphate of calcium. With sulphuric anhydride = 46·51 per cent., lime 32·56, water 20·93, the formula may be written $\dot{C}a\dot{S} + 2H_2$ or $CaSO_4 + 2H_2O$ or $SO_2Cao'' + 2OH_2$.

Loc. Roscommon Cliff, St. Just; St. Minver, in nodular or concretionary masses of volcanic rock (N. Whitley, Journ. Roy. Inst. Corn); Branscomb, and near Axmouth, in fissures of the cliffs; and other parts of Devonshire.

Obs. It is not unfrequently found in steam boilers in the two counties. Some fine crystals were obtained, years ago, in a boiler at the East Tamar Mines, Devon, and lately from a boiler from Great Huel Busy, near Chacewater. The large masses of so-called "Slipper Iron" from Virtuous Lady Mine are probably pseudomorphous after selenite. Fig. 158 is a common form of selenite crystals.

Angles.

M M =	111° 12′	M l =	131° 00′
M b	124 19	l b	108 09

H.

Hackly. Covered with small wiry points. The fracture of a piece of native or artificially produced copper is "hackly."

Haidingerite. See Berthierite.

Hair Pyrites. See Millerite.

HALITE.

[Common Salt. Chloride of Sodium.] Cubic; in cubes variously modified, with perfect cubical cleavage; more usually massive, fibrous, compact, stalactitic, or granular; brittle; fracture conchoidal; transparent to translucent; lustre vitreous or resinous; colourless, or white, grey, blue, yellow, or brown; streak white; H. 2-2·5; G. 2·2.

B., etc. In matrass decrepitates and gives off H_2O; on C fusible at about 3, colouring the flame yellow; readily soluble in water.

Comp. Anhydrous chloride of sodium, NaCl, with chlorine 60·34, sodium 39·66.

Loc. Pseudomorphous crystals were found in a shallow cutting by the side of the Taunton and Ilminster turnpike-road, near Blackbrook; and also associated with the water-stone beds, in the face of the cliff between Sidmouth and Salcombe Mouth, by Mr. G. W. Ormerod, F.G.S. (Rep. and Trans. Devon Assoc., vol iii., p. 78.)

Obs. It may always be readily known by its taste.

Hardness. A character of much importance in the discrimination of minerals. The "hardness" of a mineral (H.) may be conveniently expressed by comparing it with the following "scale of hardness:"—

1. Talc.	6. Orthoclase.
2. Gypsum.	7. Quartz.
3. Calcite.	8. Topaz.
4. Fluor.	9. Corundum.
5. Apatite.	10. Diamond.

The "hardness" of a mineral may be determined in different ways—

1st. By attempting to scratch it with the minerals mentioned in the above list, successively.

2nd. By passing a finely cut file over the specimens, with a rather firm pressure, three or four times.

3rd. By attempting to scratch the specimens with a knife.

Several trials should be made to obtain certain results, and each method should be tried, if possible. Thus, suppose the specimen is a piece of Chalcocite, No. 2 (gypsum) fails to scratch it; but No. 3 (calcite) scratches its surface readily. Next, reversing the method, it is found that the specimen will scratch No. 2 readily, but not No. 3. On trying it with the file it is not rubbed away so readily as No. 2, but more readily than No. 3. It would be sufficient to set down its hardness as 2·5. Easy as the method is, some precautions should, nevertheless, be observed. Thus, in a fibrous specimen, a scratch directed *across* the fibres will always indicate a lower degree of hardness than the true one; the scratch should, therefore, be parallel to the fibres, or, still better, on the surface of a transverse fracture. Again: a sound, undecomposed specimen should always be selected, since the hardness of minerals is greatly affected by partial decomposition near the surface.

Many minerals are *softer* when first obtained than after they have been kept in dry cabinets for some time.

In crystals the edges and angles are often considerably harder than the faces, and of the primitive form than of the modifications.

A series of substitutes has been arranged for use when a scale of hardness is not at hand, *i.e.*:—

1. May be readily scratched with the nail.
2. Is scarcely impressed with the nail; does not scratch a piece of copper.
3. Scratches a piece of copper, but is also scratched by it.
4. Not scratched by a piece of copper, does not scratch glass.
5. Scratches glass slightly; is easily scratched with a knife.
6. Scratches glass easily; is scratched a little with a good knife.
7. Is not scratched with a knife, but may be filed slightly.
8. Scratches rock crystal.
9. Scratches a topaz.
10. Scratches a ruby.

Harsh. Minerals which, like Actinolite, feel rough, are sometimes said to be "harsh."

Haytorite. A variety of quartz occurring in crystals which are pseudomorphous after Datholite is so called. It occurred at the Haytor iron mines in Devonshire, and at North Roskear, near Camborne. See Pseudomorphs.

Heavy Spar. See Barytes.

Hedyphane. See Mimetite.

Heliotrope. See Calcedony (Bloodstone).

HEMATITE.

[Specular Iron. Iron Glance, &c.] Hexagonal; crystals often tabular, and frequently macled, like Figs. 226, 230, 232, 233; some faces striated or uneven; also columnar, granular, lamellar, compact, stalactitic, botryoidal; scaly, friable, or earthy; brittle; fracture of compact varieties usually deep conchoidal, of crystals uneven; subtranslucent to opaque; lustre metallic or sub-metallic, splendant to glimmering; dark steel-grey to iron-black, often iridescent; earthy varieties red or dark reddish-brown; streak red to reddish-brown; often feebly magnetic; conductor of electricity; H. 5·5-6·5, earthy varieties sometimes soft: G. 4·5-5·3.

Var. a. Specular Iron (Elba Iron) is a crystallized variety, with iron-black colour and very brilliant lustre.

b. Micaceous Iron Ore (Scaly Red Iron Ore) is a variety which occurs in scales, or fine red or dark grey plates.

c. Kidney Iron Ore (Fibrous Red Iron Ore) is a botryoidal or reniform variety, with a radiated, and sometimes concentric lamellar structure. A similar variety of hydrous oxide of iron is also called Kidney Iron.

d. Red Hematite is a compact and massive variety.

e. Red Chalk, Red Ochre, and Reddle are impure earthy varieties, often very soft.

f. Jaspery Iron Ore is a kind of quartz containing a large proportion of oxide of iron.

B., etc. In matrass no change, or becomes somewhat darker in colour; on C infusible; if powdered and strongly heated becomes magnetic, and darkens in R F; with borax and micro. gives Fe reactions; soluble more or less readily in warm HCl, forming a yellowish solution.

Comp. Anhydrous peroxide of iron. Pure specimens contain of iron 70·0 per cent., oxygen 30·0 per cent., when the formula is $\dot{F}e_2$ or Fe_2O_3.

Loc. Specular Iron—Restormel; Huel Maudlin, near Lostwithiel, Huel Beauchamp, near Redruth; Tincroft, Carn Brea, Dolcoath, East Pool, and other mines in Illogan and Camborne; Botallack (Fig. 223), with aragonite; Boscaswell; Parknoweth; Huel Owles; Carnyorth; Huel Bellon; Huel Maggot; Hennock, near Chudleigh; Lustleigh; Birch Tor Mine, near North Bovey; and other localities in Devon.

Micaceous Iron Ore—Restormel; Carn Brea; Tincroft; Huel Druid; Levant; Little Rounds; and other localities.

Kidney Iron Ore and Red Hematite—Botallack, Levant, and most of the St. Just Mines; Huel Rave and Huel Rose, near Helston; Treluswell, near Penryn, with magnetite; Ladock, near Grampound; Davidstow; Birch Tor Mine, near North Bovey; Lustleigh; Buckfastleigh; Hennock, near Chudleigh; and several places on Dartmoor; Huel Forest, near Okehampton; Bratton Fleming, Shirwell; East Down; Viveham, Georgeham, and other places near Barnstaple; Orleigh Court, near Bideford, forming a breccia with chert and flint in greensand; in greensand at Buckland Brewer; Ilfracombe; Combemartin; Lynton; West Down; North Moulton; Brixham, &c.

Red Ochre—Ladock; Davidstowe; and many other of the above-named localities.

Red Chalk—Little Bounds, St. Just; Ladock; and Broad Down, Farway, near Honiton; Peak-hill, near Sidmouth.

The chief forms of Hematite are found in most mining districts.

Obs. Hematite may be distinguished from goethite and limonite by its being anhydrous; from these ores and magnetite by the colour of its streak. The earthy varieties, however, often yield a little water when heated in a matrass, and sometimes have a brownish streak.

Angles.

R R′ =	93°	50′	u u =	143°	07″
R o	122	30	u o	158	35

Hemihedral. A term applied to crystals which have only one-half of their planes developed. Thus, the tetrahedron (Fig. 33) is the hemihedral form of the octahedron (Fig. 1). If equal slices were to be taken from each alternate face of the octahedron until four of the faces were entirely destroyed, the resulting figure would be the tetrahedron.

Hemitrope. A macle.

Hepatic. Liver-like. A term applied sometimes to a peculiar form of mineral, when it has much the same meaning as *reniform*, and also to a peculiar colour observed in some minerals. Thus, some varieties of pyrites readily decompose to a liver-coloured mass.

HISINGERITE.

[Thraulite.] Amorphous; massive and reniform, or compact in concentric crusts; with rough surfaces; brittle; fracture conchoidal or uneven; opaque; lustre resinous, inclining to adamantine; brownish or bluish-black; streak yellowish-brown or pale reddish-brown; H. 3·5-4; G. 1·74-3.

B., etc. In matrass yields much water with an acid reaction; on C alone fuses with difficulty to a reddish, steel-grey, or black magnetic bead; with borax and micro. gives Fe reactions; partially soluble in HCl or HNO_3, leaving a gelatinous residue of silica.

Comp. Hydrated silicate of iron. The proportion of silica varies from 27·0 to 36·0 per cent., proto-peroxide of iron 44·0 to 53·0 per cent., water 10·0 to 21·0.

A mean of three analyses of a Cornish specimen (sp. gr. 1·74), by Professor Church, gave—

Peroxide of iron	52·94
Silica	36·14
Phosphoric anhydride	trace
Magnesia	trace
Water	10·49
Total	99·57

With peroxide of iron 50·6, silica 38·0, water 11·0, the formula might be written $\dot{\dot{F}}e_2\dot{S}i\dot{2}H_2$ or $Fe_2O_3 2SiO_2 + 2H_2O$ (oxygen ratio = 3. 4. 2).

Loc. Cornwall (Huel Gorland?), on Autunite; also on iron pyrites, in cavities, with Limonite, Vivianite, and Cronstedtite, probably from another locality.

Obs. It was obtained from Mr. Talling in the first instance, by Professor A. H. Church, who identified it, it having been mistaken for Beraunite.

Holohedral. A term used in opposition to "hemihedral," which see.

Hornblende. See Amphibole.

Horn Lead. See Cromfordite.

Hornstone. See Calcedony.

Horseflesh Ore. See Erubescite.

Hydrate. A compound of an oxide with water, or a metal with hydroxyl. Thus the hydrate of the oxide of copper (cupric hydrate) may be written $CuOH_2$ as a compound of oxide of copper with water; or CuH_2O_2 or $CuHo_2$, in which it is looked upon as a compound of copper with hydroxyl.

Hydrated. Containing water as a constituent part, and not merely as external moisture. Water which is given off at a temperature *above* 100° C is usually considered to be water of hydration.

Hydrofluoric Acid. See Fluorine.

Hydrous Oxide of Iron. See Limonite and Goethite.

HYPERSTHENE.

Oblique; crystals usually imperfect and imbedded, when perfect usually somewhat like Fig. 160 (Pyroxene, with which Hypersthene is isomorphous); one perfect cleavage, often curved, or

striated; another at right angles, imperfect; fracture uneven; translucent to opaque; lustre vitreous or resinous, usually pearly or sub-metallic on cleavages; grey, green, red, yellow, brown, black; streak white or grey; H. 4-6; G. 3·2-3·6.

Var. 1. Hypersthene proper has very dark colours, and often a greenish-grey streak; H. 6; rather readily fusible.

2. Bronzite colours dark, and inclining usually to brown; white streak; H. 5-6; almost infusible; often brittle.

3. Diallage. Colours usually light; white streak; H. 4; often easily fusible.

4. Hypersthene rock, Diallage rock, Gabbro, &c., are names given to rock masses, composed largely of some form of hypersthene, with a great deal of felspar, as in the cliffs at Coverack Cove and the boulders on Cronsa Downs.

B., etc. In matrass no change; on C alone usually fusible to a dark magnetic globule, or enamel; with soda and borax gives the reactions for iron, and sometimes those of manganese; insoluble in HCl or HNO_3.

Comp. Anhydrous silicate of magnesia, iron, and lime; but of very variable composition.

Loc. Coverack Cove (Bronzite?), Kynance Cove (Diallage?), and other parts of the Lizard district; St. Cleer (?). Hypersthene occurs in Scotland, Norway, Sweden, Italy, North America, &c.

Obs. Hypersthene should, perhaps, be included with pyroxene and amphibole, in one large group, only separable into sub-species. The chemical composition seems to be in all, too variable to serve as a means of classification in species, and they are isomorphous with each other.

I.

Iceland Spar. See Calcite.

ILMENITE.

[Manaccanite. Titaniferous Iron. Titanite. Iserine. Kibdelophan, &c.] Hexagonal; in tabular crystals, somewhat like Figs. 200, 201, and 230, but with curved faces; or drusy; also massive, granular, or disseminated; brittle; fracture conchoidal or uneven; opaque; lustre metallic or sub-metallic, brilliant to glimmering; iron-black, brown, or steel-grey; streak reddish-brown to black; sometimes slightly magnetic; H. 5-6; G. 4·6-5·0.

Var. a. Ilmenite occurs crystallized or massive.

b. Manaccanite was a term given to the grains of titaniferous iron-sand found at Manaccan.

c. Iserine is the term applied to a dark sand of similar composition, found at Iserweise, in the Riesengebirge.

B., etc. In matrass unchanged; on C unchanged, or turns brown; with micro. or borax gives the reactions for Ti; the fine powder is slowly soluble in concentrated HCl; the concentrated solution will, after a time, yield a precipitate of titanic anhydride after dilution and boiling; imparts a blue colour to H_2SO_4 if boiled in it.

Comp. An anhydrous compound of the oxides of titanium and iron. Of the following analyses of Cornish specimens a. was by Klaproth, b. by Gregor, c. by Lampadius:—

	a.	b.	c.
Oxide of titanium...	45·25	45·00	43·5
Oxide of iron..... ..	51·00	46·00	50·4
Oxide of manganese	0·25	trace	0·9
Silica	3·50	trace	3·3
Alumina	—	—	1·4
Total	100·00	91·00	99·5

With 48·0 per cent. of titanic anhydride and 52·0 per cent. of ferric peroxide the formula may be $\dot{\dot{T}}i_2\dot{\dot{F}}e_2$ or $Ti_2O_3+Fe_2O_3$ or $T\dot{\dot{i}}\dot{\dot{F}}eO_3$.

Loc. Manaccan, in the bed of a rivulet, as a black sand; Gwendra, near Coverack, disseminated, in diallage rock; Lannarth, near St. Keverne, in a stream as a dark sand; recently at Porthalla, in a ferruginous deposit, both massive and crystallized. The crystals were lenticular, with curved faces, and varying from 1-10th to ¼ of an inch in diameter.

Obs. It may most readily be distinguished from Hematite by its dark brown streak and reactions with micro.

Incandescent. Glowing; combustion without flame; when charcoal is heated before the blowpipe it glows, but rarely bursts into flame. This is incandescence.

Incrustation. A term applied to the deposit which is formed on the cool part of a charcoal or fire-clay support when ores of arsenic, antimony, or lead are heated. It may always be driven away by directing the blowpipe flame on the part, and in this manner may be easily distinguished from the white ash left by the combustion of some varieties of charcoal.

Indigo Copper. See Covellite.

Indurated. Hardened. Talc, Kaolin, and other minerals seem sometimes to be greatly hardened when in contact

with igneous rocks, as if baked. They are then said to be indurated.

Infusible. That which cannot be fused or melted. Minerals are said to be infusible if they cannot be fused by means of an ordinary blowpipe flame, although they may be mostly fused by using the oxy-hydrogen blowpipe.

Investing. A term applied to minerals which occur spread in a thin coating over the surface of some different kind of mineral or rock.

Iridescent. Exhibiting colours something like those of a rainbow.

Iridescent Copper Pyrites. See Chalcopyrite (Peacock Copper).

Iris. See Quartz.

Iron Flint. See Quartz.

Iron Glance. See Hematite (Specular Iron).

Iron Mica. See Hematite (Micaceous Iron Ore).

Iron Nickel Pyrites. See Pentlandite.

Iron Ochre. See Hematite and Limonite.

Iron Pyrites. See Pyrites.

Iron Rutile. See Goethite.

Iron Spar. See Chalybite.

Isomorphism. "Similarity in crystalline form exhibited by substances of similar chemical constitution." Thus the following mineral carbonates crystallize in forms having a very great resemblance to each other, all being hexagonal, and their primary or cleavage rhombohedrons having faces similarly inclined to to each other, and varying only from 105° 03′ to 107° 54′:—

Calcite	$CaCO_3$ =	105·03
Dolomite	$(MgCa)CO_3$	106·15
Diallogite	$MnCO_3$	106·51
Chalybite	$FeCO_3$	107·00
Mesitine Spar	$(FeMg)CO_3$	107·14
Magnesite	$MgCO_3$	107·25
Calamine	$ZnCO_3$	107·54

A similar group of isomorphous carbonates, crystallizing in the rhombic system, is the following, the angles being those of the prisms:—

Aragonite	$CaCO_3$ =	116°	10′
Cerussite	$PbCO_3$	117	14
Strontianite	$SrCO_3$	117	19
Witherite	$BaCO_3$	118	30

Similar groups of isomorphous minerals are known in each system of crystallization, when it is found that there is a tendency for one member of a group to take the place of another in a compound, thus leading to a *passage* from one to another. In fact, it seldom happens that one member of an isomorphous group is quite free from traces at least of another. For further information on this interesting subject see the works of Mitscherlich; Frankenheim's Systeme der Krystalle; or Brooke and Miller's Elementary Introduction to Mineralogy, 1852.

ISOPYRE.

Amorphous; compact; brittle; fracture conchoidal or uneven; translucent on thin edges, or opaque; lustre vitreous or dull; greyish or velvet-black, sometimes with reddish spots; streak pale greenish-grey; H. 5·5-6·5; G. 2·9-3; slightly magnetic.

B., etc. In matrass not changed; on C fuses readily to a magnetic globule, sometimes colouring the tip of the flame greenish; with borax and micro. gives Fe reactions; imperfectly decomposed by HCl or HNO_3, leaving a deposit of silica; the powder is decomposed by strong solution of carbonate of potash.

Comp. Anhydrous silicate of iron, alumina, and lime (?). The following analysis of a specimen from St. Just was made by Turner:—

Peroxide of iron	20·07
Alumina	13·91
Lime	15·43
Oxide of copper	1·94
Silica	47·09
Total	98·44

Loc. Huel Carne, St. Just, in masses of several inches in length, in granite, associated with Cassiterite and Tourmaline; it is also said to have been found near St. Ives.

Obs. In appearance it is not unlike Obsidian, but less lustrous. It has been thought to be an impure variety of opal or jasper.

J.

Jade. A substance which has sometimes been so named is described as Saussurite, which is itself perhaps only a variety of Pyroxene. See Saussurite.

JAMESONITE.

Rhombic, usually in aggregations of imperfectly formed acicular prisms, with a perfect basal cleavage at right angles to the prismatic faces; or fibrous, columnar, or massive; sectile; opaque; lustre metallic; dark steel grey; streak black, or very dark; H. 2-2·5; G. 5·5-5·8.

Var. Feather ore is a variety which occurs in soft masses, with interlacing fibres, like felt.

B., etc. In matrass decrepitates, and yields a reddish or yellowish sublimate; on C fuses at 1 to a dark mass, which is partly absorbed by the charcoal; deposits

a yellow incrustation; may be entirely volatilized in O F, except a little infusible slag, which gives Fe or Mn reactions; in R F yields, after a good deal of blowing, a malleable bead of lead; decomposed by warm HCl, leaving a white ppt.

Comp. It is an anhydrous sulphide of lead and antimony. The following analyses, by H. Rose, are all of Cornish specimens:—

	a.	b.	c.
Lead	40·75	40·35	38·71
Antimony	34·40	33·47	34·90
Sulphur	22·15	nt. det.	22·53
Iron	2·30	2·96	2·65
Copper	0·13	0·21	0·19
Zinc	—	trace	0·74
Total	99·73	—	99·72

With lead = 43·6, antimony 36·2, and sulphur 20·2, the formula might be written $Pb_3Sb_4S_9$ or $2PbS\ Sb_2S_3 + PbS$.

Loc. Near Padstow; Port Quin Cliffs, and Trevinnock, near Endellion, with bleinierite; Port Isaac, Pendogget, Huel Lee, Calstock; Huel Boys; Tintagel; found also in Spain, Hungary, Siberia, Brazil, &c.

Obs. It usually occurs with other ores of antimony. It may be distinguished from antimonite by its basal cleavage, yellow incrustation when heated on charcoal, and by its yielding a bead of Pb in RF.

JASPER.

Amorphous; tough; fracture conchoidal, uneven, or splintery; opaque; lustre resinous or dull; sometimes white, but more usually grey, yellow, red, brown, green, or black, sometimes mottled of various colours; streak white or slightly coloured; H. 6-7; G. 2·6-3·0.

Var. a. Ribbon Jasper has the colour arranged in stripes, or bands.

b. Lydian Stone, Tin Flint, Touchstone, or Basanite, is of a velvet-black colour, and has a flat conchoidal fracture. It is sometimes placed with Calcedony.

c. Bloodstone seems to be partly Jasper and partly Calcedony. It is of a dark green colour, spotted with red.

d. Eisenkiesel, or Iron Flint, is a brown and somewhat earthy variety.

B., etc. In matrass unchanged, or gives off a little water; on C infusible; with soda fuses readily to a coloured bead, with much effervescence; insoluble in HCl, HNO_3, or H_2SO_4.

Comp. Anhydrous silica. It usually contains, however, a small proportion of water, and a variable proportion of peroxide of iron, and other oxides.

Loc. Botallack, Huel Owles, Levant, Cape Cornwall, Huel Spearn, Little Bounds, Huel Stennack, and other mines in St. Just, of various colours, as red, black, green, &c.; Ding Dong, Madron; Marazion Beach; Looe Bar; Tremearne; North Roskear, Dolcoath (red and black); Redruth; Huel Unity; St. Austell; Trugoe; Huel Maudlin; in greensand at Buckland Brewer; Ivybridge; Doddiscombleigh; Blackdown-hills; Brent Tor; Okehampton; near Exeter; Haldon, near Teignmouth, pale red; and many other places in the two counties. Very fine masses of Jasper are obtained from Egypt, Italy, Germany, &c.

Obs. It can only be regarded as an impure mixture of *crystalloid* and *colloid* silica, with various metallic oxides. Porcelain Jasper, or Porcellanite, is of quite a different composition; it is simply a greatly hardened (baked?) clay.

Jaspery Iron Ore. A siliceous variety of Hematite, or a very ferruginous Jasper.

JOHANNITE.

[Uran-Vitriol.] Oblique; in small flattened prisms, reniform masses, or druses; transparent to opaque; lustre vitreous; emerald or yellowish-green; streak pale green; taste bitter and astringent; H. 2-2·5; G. 3·19.

B., etc. In matrass yields water with acid reactions, and turns brown; on C is fusible at first, but leaves finally a dark infusible residue; with borax and micro. gives the reactions for Uranium; slightly soluble in H_2O.

Comp. Hydrous sulphate of Uranium.

Loc. Johannite has, perhaps, occurred at South Huel Basset, in transparent, bright yellow crystals, with other ores of Uranium. (See Trans. Roy. Geol. Soc. Corn., vol. vii., p. 86.) The true Johannite occurs in Germany and the United States.

Obs. It is probably a product of the decomposition of the ores of Uranium. Its solubility in water would of itself account for its rarity in a wet county like Cornwall.

K.

KALINITE.

[Alum. Potash Alum.] Cubical; crystals usually like Figs. 1, 2, 3, or combinations of these; generally in crusts, fibrous masses, or as an efflorescence; fracture conchoidal or uneven; transparent or translucent; colourless, white, or slightly tinted with green, yellow, or blue; streak white; taste sweetish-astringent; H. of compact specimens 2-2·5; G. 1·75-1·9.

B., etc. In matrass melts at first, yields a large quantity of water with acid reaction; on C the same, and gives off SO_2; the white residue becomes blue if treated with Co; soluble readily in water.

Comp. Hydrated sulphate of potash and alumina. With sulphuric anhydride 33·76, alumina 10·82, potash 9·95, water 45·47, its formulæ may be written $\dot{\ddot{A}}l_2\,2\dot{K}\,4\ddot{S} + 24H_2$ or $S_4O_8Ko_2Al_2o^{vi} + 24OH_2$.

Loc. It is said to occur in clay at Chudleigh, in Devon (Greg and Lettsom, p. 71).

Obs. It is extracted from shales in large quantities in Yorkshire, near Whitby, and other places.

Kampylite. See Mimetite.

Kann. See Fluor.

Kaolinite. Dana. Rhombic, appearing as hexagonal scales under the microscope. Perhaps may be found in the Cornish and Devonshire Kaolins.

KAOLIN.

[China Clay, Lithomarge, &c.] Amorphous; massive, in beds, veins, or disseminated; should, perhaps, be regarded rather as a *rock* than a *mineral*; fracture earthy; sectile, brittle, or friable; opaque; dull; adherent; unctuous or plastic while moist, sometimes meagre when dry; white, grey, or bluish, yellowish, brownish, &c., from various impurities; streak like colour; H. 1-3; G. 1·8-2·7.

Var. a. China Clay is the pure white variety, used for the best kinds of pottery.

b. Lithomarge is a peculiar indurated variety, with H. 2-2·5: G. about 2·6; sometimes pyro-phosphoric.

c. Carnat is a flesh-coloured variety, containing a good deal of iron.

B., etc. In matrass gives off water; on C is infusible, and often loses colour; treated with Co turns blue; not readily decomposed by HCl or HNO_3.

Comp. Hydrated silicate of alumina, with very often potash. Of the following analyses a. was from Breage, analysed by Dr. Boase; b. from St. Stephens, ditto; c. from Devon, by Berthier; d. from Dartmoor, by Fownes:—

	a.	b.	c.	d.
Silica	40·15	39·55	50·51	47·20
Alumina	36·20	38·05	38·18	38·80
Peroxide of iron	—	—	—	trace
Magnesia	1·75	1·45	—	0·24
Potash & loss	9·50	8·70	—	1·76
Water	11·65	12·30	11·02	12·00
Total	99·25	100·05	99·71	100·00

e. is the analysis of a specimen from Devonshire; f., from Dartmoor; g., a kaolin earth from Plympton; h., a yellowish-white lithomarge, with peach-coloured veins, from Cook's Kitchen, by Reeks (Trans. Roy. Geol. Soc. Corn., vol. vii., p. 76):—

	e.	f.	g.	h.
Silica	44·26	44·25	40·9	48·3
Alumina	38·81	36·81	44·5	36·4
Peroxide of iron	—	—	—	0·8
Lime & potash	—	2·20	—	—
Water	12·74	12·70	15·3	14·5
Total	95·81	95·96	100·7	100.0

With silica 46·7, alumina 41·1, water 12·2 the formula may be written $2\ddot{A}l_2\,3\ddot{S}i + 3H_2$ or $2(Al_2O_3SiO_2) + SiO_2 + 3H_2O$ or $Si_3(Al_2o^{vi})_2 + 3OH_2$.

Loc. a. China Clay—Balleswidden, and other St. Just mines; Tregoninghill, Breage; Vogue, near St. Day; East Huel Damsel; St. Stevens and St. Dennis, Carclaze, and many other places near St. Austell; Chytane, St. Enoder; Cligga Head, St. Agnes; Great Dowgas; Bovey Tracey; Dunscomb-hill, near Sidmouth; Plympton; Fownes; on Dartmoor; and many other places in Cornwall and Devon.

b. Lithomarge — Balleswidden, and other mines at St. Just; near St. Ives; Cook's Kitchen, Tincroft, Dolcoath, Carn Brea, and other mines near Camborne; Huel Druid; Huel Basset; West Basset; South Huel Frances; Carharrack; Ting Tang; West Huel Jewell; St. Blazey; in amorphous yellow masses with agate at Hay Tor; with apatite and tourmaline at Bovey Tracey.

Obs. Kaolin is a substance of immense importance in the arts. In an impure form it probably composes all the clays of the earth's crust, and when indurated forms *slates* and *shales*. It should rather be described as a rock than a mineral.

Kassiterite. See Cassiterite.

KERATE.

[Kerargyrite. Horn Silver.] Cubic; in small modified cubes, octahedrons, or rhombic dodecahedrons (Figs. 1, 2, 3, 8, to 16); sometimes acicular, columnar, massive, or investing; sectile or malleable; fracture conchoidal or uneven; translucent to almost opaque; resinous or waxy; pearl-grey, greenish, bluish, or brown, especially on exposure to light; streak white and shining; H. 1-1·5; G. 5·3-5·6.

B., etc. In matrass melts without further change; on C fuses readily, and is easily reduced to a malleable bead of

silver; if mixed with oxide of copper tinges the flame bright blue; if moistened and rubbed on a plate of polished iron, metallic silver is deposited; insoluble in HCl or HNO_3; slowly soluble in ammonia, and re-precipitated by HCl.

Comp. Anhydrous chloride of silver. Pure specimens contain 75·34 per cent. of silver and 24·66 per cent. of chlorine, the formula will therefore be AgCl.

Loc. Huel Herland; Huel Alfred and Huel Ann, Phillack; Huel Duchy, in brown gossan, in forms resembling Figs. 8 and 12; Huel St. Vincent, near Calstock, with native silver; Silver Valley; Huel Brothers; Huel Mexico and Huel Basset, Perranzabuloe, crystallized and massive; Dolcoath; North Dolcoath (Figs. 1, 8, 12); Botallack, Levant; found also in Ireland, and in many foreign silver producing districts.

Obs. In Cornwall it usually occurs with other ores of silver, hydrous oxide of iron, quartz, and ores of copper. Mr. Carne observes, "It has not yet occurred in any Cornish mine whose lode traverses granite." (Trans. Roy. Geol. Soc. Corn., vol. vii., p. 87.)

Angles. Same as Cuprite.

Killas. A Cornish term for the altered clay-slate of the district.

Klinoclase. See Clinoclase.

Kupferindig. See Covelline.

Kupfernickel. See Niccolite.

L.

Lamellar. Minerals which can be split up into plates are so called. *Ex.* Barytes, Fluor, &c. *Foliated* is the same, but the plates are very thin.

LANGITE.

Rhombic; crystals usually small and short, in forms not unlike those of aragonite; also fibro-lamellar, concretionary, or investing ("rippled"); the surface sometimes earthy; transparent or translucent; lustre of crystals vitreous, of thin crusts silky; colour blue or greenish-blue; H. 2·5-3, crusts softer; G. 3·48-3·5.

B., etc. In matrass gives off water with acid reaction, and turns black; on C gives off a sulphureous odour, and easily yields a bead of copper; soluble in HCl.

Comp. Hydrated basic sulphate of copper. The following analyses are all very recent:—

	a.	b.	c.	d.	e.	f.
Sulphuric anhydride	16·42	16·77	16·79	16·72	16·88	16·2
Oxide of copper ..	65·82	65·92	67·48	67·31	67·88	68·1
Lime	—	0·33	—	—	—	0·5
Magnesia	—	0·29	—	—	—	—
Water ..	18·32	16·19	15·73	16·25	15·53	15·2
Total	100·56	100·00	100·00	100·28	100·29	100·0

a. is an analysis by Maskelyne, b. by Pisani, c. by Church, d. and e. by Warrington, f. by Tschermak. With sulphuric anhydride 16·4, oxide of copper 65·2, and water 18·4 the formula may be written $\dot{4}\dot{C}u, \dot{S}, \dot{5}\dot{H}_2$ or $CuSO_4+3CuH_2O_2+2H_2O$ or $SO_2Cuo^{\prime\prime}3CuHo_3+2OH_2$.

Loc. Copper Hill Mine and Huel Basset, Redruth; East Pool, Dolcoath, and other mines near Camborne.

Obs. It is found on killas, in brilliant minute macled crystals of a beautiful deep blue colour, or "rippled" crusts of a greenish-blue tint and somewhat earthy appearance. The name Devilline was at first given to a very similar mineral. (See Comptes Rendus for 1864, pp. 813, 633; see also Journ. Chem. Soc., II., iii., 87; Phil. Mag., IV., xxiii., p. 306, 1864; Phil. Mag., IV., xxii., p. 473, 1865; Chem. News, x., 263, 1864, &c.)

Lapis Ollaris. See Steatite (Potstone.)

Lazurite. See Chessylite.

Lateral. This term is applied to the secondary axes in the *pyramidal* and *hexagonal* crystallographic systems.

Lead Earth. A term applied to the earthy variety of Cerussite.

Lead Glance. See Galena.

Lead Ochre. See Plumbic Ochre.

Lead Spar. See Cerussite.

Lenticular. Lens-shaped. Crystals which are nearly flat circular scales, but slightly convex above and below. *Ex.* Some specimens of Hematite and Ilmenite.

Lenticular Arseniate of Copper. See Liroconite.

LEPIDOLITE.

[Lithia Mica.] Rhombic; rarely in prisms, with perfect basal cleavage; usually in pinkish granular masses, interspersed with small flexible translucent scales; lustre pearly; peach-blossom red to pearl-grey, white, or brownish; crystals dichroic; H. 2·3; G. 2·8-3.

B., etc. In matrass scarcely altered; on C fuses more or less readily to a transparent and nearly colourless glass; colours flame red, especially if just moistened with HCl or H_2SO_4, or mixed with $KHSO_4$; insoluble in HCl, HNO_3, or H_2SO_4, but readily decomposed by HCl after ignition.

Comp. Anhydrous silicate of alumina, iron, potash, and lithia, with some fluoride. Of the following analyses of Cornish specimens a. is by Turner, b. and c. are by Rammelsberg, d. is a recent analysis by Haughton, of a white, pearly specimen, from Tremearne, in Breage, which occurred in rhombic tables of 60° and 120°:—

	a.	b.	c.	d.
Silica	50·82	51·70	52·40	47·60
Alumina	21·33	26·76	26·80	27·20
Protoxide of iron	9·08	—	—	—
Peroxide of iron	—	—	—	5·20
Oxide of manganese	trace	1·29	1·50	1·20
Lime	—	0·40	—	0·45
Magnesia	—	0·24	—	trace
Potash	9·86	10·29	9·14	10·48
Soda	—	1·15	—	0·72
Lithia	4·05	1·27	4·35	1·14
Fluorine	4·81	7·12	4·13	—
Fluosilicon	—	—	—	5·68
Phosphoric anhy.	—	0·16	—	—
Total	99·95	100·38	98·87	99·67

Loc. St. Michael's Mount, in pale peach-coloured and silvery hexagonal scales; Trewavas Head and Tregoninghill, Breage, in white rhombic scales; Lanarth, near Redruth, nearly white; near Bovey Tracey, in white silvery plates, &c.; it occurs also in Scotland, Ireland, and many foreign localities.

LEPIDOMELANE.

Rhombic; in six-sided plates, or rhombs of 60° and 120°, with perfect basal cleavage; flexible and elastic; translucent or opaque; lustre sub-metallic, adamantine, or vitreous; dark brownish or greenish-black; dichroic; streak greenish; H. 3·0; G. 3·0.

B., etc. In matrass no change; on C melts readily to a dark magnetic globule; with borax forms a greenish glass; decomposed by HCl, leaving pearly silica.

Comp. Silicate (with fluoride) of alumina, iron, potash, and lithia. Of the following analyses a. is a Cornish specimen (brown), by Turner; b. a very dark coloured specimen from Carn Bosavern, recently analysed by Professor Haughton, F.R.S.:—

	a.		b.
Silica	40·06	..	39·92
Alumina	22·90	..	22·88
Protoxide of iron .. } Peroxide of iron .... }	27·06	..	15·02
		..	2·32
Oxide of manganese	1·79	..	1·40
Lime	—	..	0·68
Magnesia	—	..	1·07
Potash	4·30	..	9·76
Soda	—	..	0·99
Lithia	2·00	..	1·71
Fluosilicon	—	..	3·04
Fluorine	2·71	..	—
Total	100·82	..	98·79

It will be seen that lepidomelane differs mainly from lepidolite by the smaller quantity of silica, and the presence of a large proportion of iron.

Loc. Carn Bosavern, St. Just, and many of the Cornish granites.

LEUCOPYRITE.

[Arsenical Pyrites. Lölingite, &c.] Rhombic; the usual combination is much like Fig. 115, without the plane O; one perfect cleavage; more usually massive; compact, granular, or columnar; sometimes disseminated; brittle; fracture uneven; opaque; lustre metallic; silvery-white to steel-grey, often a yellow or brown tarnish; streak greyish-black; H. 5-5·5; G. 6·9-7·4.

B., etc. In matrass gives an abundant white or yellowish sublimate, which is dark and metallic below; on C fuses readily to a black magnetic mass, depositing a white incrustation, and giving off copious arsenical fumes; with borax gives Fe reactions; insoluble in HCl; soluble in HNO_3, with a separation of As_2O_3.

Comp. Arsenide of iron, with a little S, and sometimes Ni and Co. No analysis of a British specimen is known to the author, but foreign specimens yield about 30·0 per cent. of iron and 70·0 per cent. of arsenic. With iron = 32·6 and arsenic 73·5 the formula will be $FeAs_2$.

Loc. East Pool, Dolcoath, and probably many other Cornish mines. It occurs largely in Norway and Germany.

Obs. It has been usually mistaken for mispickel, from which it may be distinguished by its small proportion of of sulphur and its greater sp. gr. It not unfrequently contains paying quantities of gold and silver.

LIBETHENITE.

[Phosphate of Copper.] Rhombic; mostly in small crystals, like Fig. 139; also globular, reniform, radiated, or compact masses; brittle; fracture conchoidal or uneven; translucent on thin edges; lustre somewhat resinous; olive or blackish-green; streak olive-green; H. 4; G. 3·6-3·8.

B., etc. In matrass gives off water, turns black, and often decrepitates; on C fuses to a dark globule of metallic appearance; in R F with soda yields a bead of copper, sometimes a slight alliaceous odour; soluble in HCl or ammonia, still more readily in HNO_3, forming a blue solution; decomposed by KHO, the solution when neutralized with HNO_3 yields a pale yellow ppt. on addition of solution of nitrate of silver.

Comp. Hydrated phosphate of copper. Specimens from Libethen, in Hungary, yield about 66·5 per cent. of oxide of copper, 29·7 per cent. of phosphoric anhydride, and 3·8 per cent. of water. With these proportions the formula may be written $Cu_3P_2+CuH_2$ or $3CuO, P_2O_5+CuH_2O_2$ or $P_2O_3Cuo''_3+CuHo_2$.

Loc. Gunnislake, Callington, formerly, with gozzan, quartz, and pyrites; it was also found at South Huel Frances and some of the Gwennap mines (?), by the late Mr. John Garby. Its chief foreign localities are Hungary, Germany, the Ural, South America, &c.

Obs. This species is isomorphous with Olivenite, and the phosphoric anhydride is often partially replaced by arsenic anhydride.

Angles.

M M′ =	92°	20′	s e =	149°	06′
M s	135	53	e e′	70	08
s s′	120	56			

Lime Uranite. See Autunite.

LIMONITE.

[Brown Hematite. Hydrous Oxide of Iron, &c.) Amorphous; mammilated, botryoidal, reniform; fibrous, radiating, or concentric; compact, earthy, or friable; stalactitic, &c.; brittle; fracture conchoidal, uneven, or earthy; opaque; lustre sub-metallic, resinous, silky, or dull; brown, to yellowish or black; streak yellowish-brown; H. 5-5·5, except *ochre* and *umber*, which are often less than 1; G. 3·4-4.

Var. a. Brown Hematite is a reniform variety, with sub-metallic or silky lustre, and concentric fibrous structure. It is sometimes called Kidney Iron.

b. Wood Hematite has bands of yellow and brown alternately.

c. Stilpnosiderite is a black or very dark brown variety, with conchoidal fracture and splendant lustre.

d. Bog Iron Ore, Meadow Iron Ore, or Ochrey Brown Iron Ore, is a soft variety, often found in swampy places in mining districts.

e. Yellow Ochre is a yellowish, earthy, or friable variety.

f. Brown Umber is an impure, friable, brown-coloured variety.

B., etc. In matrass gives off water and turns darker; on C infusible, turns dark, and magnetic; very thin splinters may sometimes be melted with great difficulty; with borax and micro. gives iron reactions; soluble in warm HCl, forming a yellowish solution; often leaves a portion of silica undissolved.

Comp. Hydrated peroxide of iron. Of the following analyses a. is of a Cornish specimen, by Yorke; b. and c. are recent analyses of massive specimens from Perran; d. is a rusty-yellow stalactitic specimen from Botallack, by Prof. A. H. Church (Journ. Chem. Soc., II., iii., 214):—

	a.	b.	c.	d.
Peroxide of iron	82·16	58·77	75·04	73·73
Oxide of manganese	—	3·08	2·65	—
Alumina	—	0·69	0·42	—
Lime	—	6·39	0·11	—
Magnesia	—	0·26	0·12	—
Phosphoric anhydride	1·13	6·99	1·54	—
Silica	2·42	8·01	7·18	—
Water	14·28	14·87	12·02	24·40
Total	98·99	99·06	99·08	98·13

This last specimen is considered to be a distinct species by Dana, on account of the large proportion of water. With 81·1 per cent. of peroxide of iron, and 18·9 per cent. of water the formula might be written Fe_2H_2 or $Fe_2O_3+2H_2O$ or Fe_2OHo_4. With peroxide of iron = 85·6 per cent., and water 14·4 it may be written $2Fe_2O_3+3H_2O$ or $Fe_4O_3Ho_6$.

Loc. Botallack, and the St. Just mines generally, in most of the varieties; Huel Mary, and other mines in Lelant; St. Ives Consols; Great Work; Huel Rose, Sithney; Constantine; St. Keverne; Trumpet Consols, and other mines in Wendron; Huel Herland; Carn Brea; Tincroft (Stilpnosiderite and other forms); Camborne Vean; Ting Tang, Huel Fortune, and other Gwennap mines; North Downs; Huel Towan, South Huel Towan, and several other St. Agnes mines; Perranzabuloe; Ladock; Charlestown United, Ruby and Knightor, and other mines near St. Austell, in several forms; Huel Maudlin (Stilpnosiderite and other varieties); Restormel Royal Iron Mines; Retire, Withiel, and other places in Cornwall; Five Acre, Huel Prosper, Parkins, Sharpham, Torbay, and other iron mines near Brixham; Gymton, near Paignton; Smallacombe and Hatherly, Ilsington; Shaugh, and other places near Plympton; Combemartin (umber, yellow ochre, &c.); Buckfastleigh; Huel Rebert, Sampford Spiney; Huel Betsey, near Tavistock; Copper Hill Mine, near Okehampton; on Exmoor; East Down and Viveham, near Barnstaple; Buckland Brewer, near Bideford; Ugbrook Park, near Chudleigh (umber); and many other places in the two counties.

Bog Iron Ore—Marasion; Perran Consols, in 1839, light yellowish-brown to black; "The light yellow ore appears to have formed around, and enclosed, some of the roots of the heath." (W. M. Tweedy, Rep. Roy. Inst. Corn., 1839.)

Obs. It occurs in small quantities in almost every metalliferous mine in the world, except those worked in quartz rock.

LINARITE.

[Cupreous Sulphate of Lead.] Oblique, with one perfect cleavage; brittle; fracture conchoidal; translucent; lustre vitreous to adamantine; deep azure blue; streak pale blue; H. 2·5-3; G. 5·3-5·45.

B., etc. In matrass gives off water with acid reaction, and loses colour; on C fuses to a pearly globule; in RF is easily reduced to a malleable bead, depositing a yellow coating on the charcoal, and yielding sulphureous odours; with borax, alternately RF and OF, yields a grain of copper; decomposed by HNO_3, leaving a white residue of sulphate of lead, and forming a bluish solution.

Comp. The hydrated sulphate of lead with copper specimens from Leadhills yielded to Thomson and Brook nearly 75·7 of oxide of lead, 19·8 of oxide of copper, and 4·5 of water. The formula may therefore be written $\dot{P}b\dot{S}+\dot{C}uH_2$ or $PbSO_4+CuH_2O_2$ or $SO_2Pbo''+CuHo_2$.

Loc. Very small specimens were found by Dr. C. Le Neve Foster at Huel Penrose, Sithney, about the year 1866. It occurs also in Cumberland, and at Leadhills, in Lanarkshire.

Obs. The crystals from Cumberland are not much unlike Figs. 148, 149, 151. The Cornish specimens were not crystallized distinctly.

LIROCONITE.

[Octahedral Arseniate of Copper. Lenticular Arseniate, &c.] Rhombic or oblique; in obtuse faintly striated double pyramids, like Fig. 165; crystals usually minute, but have been obtained formerly as much as one inch in length; sometimes in granular masses, but more rarely so than crystallized; sectile; fracture conchoidal or uneven; translucent; vitreous to resinous; sky-blue to verdigris-green; streak pale blue; H. 2-2·5; G. 2·8-3·0.

B., etc. In matrass gives off much water and turns dark green; on C alone deflagrates (?), fuses readily to a dark slag containing granules of copper; deposits a white incrustation on the charcoal at a considerable distance from the assay; with soda, after well roasting, yields a malleable bead of copper; easily soluble in HNO_3; decomposed when in powder by solution of KHO, leaving a black powder of oxide of copper.

Comp. Hydrated arseniate of copper. Of the following analyses of Cornish specimens a. was by Wachtmeister, b. by Hermann, c. and d. by Damour:—

	a.	b.	c.	d.
Oxide of copper	37·73	36·38	37·18	37·40
Alumina	8·61	10·85	9·68	10·09
Peroxide of iron	3·66	0·98	—	—
Arsenic anhydride	22·29	23·05	22·22	23·40
Phosphoric anhydride	3·87	3·73	3·49	3·24
Water	23·84	25·01	25·49	25·44
Total	100·00	100·00	98·06	99·57

The sp. gr. of b. was 2·985, of d. 2·964. With oxide of copper 36·61, alumina 11·87, arsenic anhydride 26·59, and water 24·93, the formula might be written $\dot{8}\dot{C}u2\ddot{A}s_2\ddot{A}l_2 + 24\dot{H}_2$ or $(CuO)_3As_2O_5 + Al_2O_3As_2O_5+5CuH_2O_2+19H_2O$ or $2As_2O_5Cuo''_3+Al_2Ho_6+2CuHo_2+19OH_2$.

Loc. Huel Muttrell, Huel Gorland, Huel Unity, Gwennap, many years since; Great Hewas United, and Gunnislake more recently, but not such fine specimens. It is also said to have occurred at Huel Providence, Lelant.

Obs. It occurred always associated with other arseniates of copper. Its beautiful colour is sufficient to distinguish it from them all.

Angles.

M M′ = 119° 20′ o o = 107° 38′

Lithia Mica. See Lepidolite and Lepidomelane.

Lithomarge. See Kaolin.

Loadstone. See Magnetite.

Localities. A complete list of Cornish and Devon localities, topographically arranged, will be found in Part I. of this book. In the case of minerals indicated with type as follows: **FLUOR** or JASPER, only the localities of the best specimens, or those remarkable for their situation, will be given; in other cases the author has given all the localities known to him.

Foreign localities are indicated, with the greatest conciseness, so as to shew the wide distribution of many minerals which are commonly supposed to be almost exclusively Cornish. Of this, Cassiterite is a noteworthy example.

Lonchidite. A peculiar variety of marcasite which formerly occurred at Cook's Kitchen and Tincroft mines, in crystals resembling Fig. 152.

LUNNITE.

[Phosphorocalcite. Pseudomalachite. Ehlite.] Oblique (?) or Rhombic? reniform; massive; fibrous; surface drusy; brittle; fracture small conchoidal or uneven; translucent or sub-translucent; lustre adamantine or vitreous; dark green; streak light green; H. 4·5-5; G. 4-4·4.

B., etc. Like Libethenite.

Comp. Hydrated phosphate of copper. The following is an analysis by Heddle; the sp. gr. of the specimen was 4·25:—

Phosphoric anhydride	22·73
Oxide of copper	68·13
Water	8·51
Silica	0·48
Total	99·85

Loc. "Only one specimen of this substance has hitherto been found in Great Britain; it is from Cornwall, and in Mr. Greg's collection. Colour verdigris-green; translucent by transmitted light. Consists of minute globular concretions, not very closely compacted." (Greg and Lettsom, Manual of Mineralogy, p. 324.) Foreign specimens have occurred in Germany, Hungary, and Siberia. Fig. 167 represents a foreign specimen.

Angles.

O e = 146° 18′ f f = 117° 49′
g e 168 46

Lustre. The reflection of light from the surface of a body occasions what is called its "lustre." The following are the chief varieties observable in minerals:—

a. METALLIC. *Ex.* Pyrites, Galena.
b. ADAMANTINE. *Ex.* Diamond.
c. VITREOUS. *Ex.* Crystallized Quartz.
d. RESINOUS. *Ex.* Some varieties of Cassiterite.
e. PEARLY. *Ex.* Pearl Spar.
f. WAXY. *Ex.* Kerargyrite.
g. SILKY. *Ex.* Fibrous Carbonate of Iron.

Each of these kinds of lustre may exist in several degrees: as "splendant," "brilliant," "shining," "glimmering." When no lustre is observable the specimen is "dull." The various kinds of lustre are also qualified by the prefix "sub." Thus many varieties of dark mica have a "sub-metallic" lustre.

The true metallic lustre is only observable in minerals which are perfectly opaque. The silky lustre is usually observable in minerals which have a fibrous structure; while the pearly lustre is often seen in minerals having a foliated or lamellar structure, and usually occurs on the cleavage planes.

M.

Macle. Twin Crystals, "Macles," or "Hemitropes" are groups of two or more crystals, which appear as if mutually intersecting each other, or as if a single crystal had been cut in two, one part turned round a certain number of degrees, and then re-united to the other. Thus, if the octahedron Fig. 54 a., Plate III., be cut in two in the direction of the dotted line, the one-half rotated 90°, and then re-united to the other, a macle like Fig. 54 b. will be the result, as in many crystals of Spinel, Alum, and other minerals. Of course, such a division and re-union has not really taken place; the whole crystal has probably taken the peculiar form from its first formation. The corresponding axes of macles are always inclined to each other, in accordance with very precise laws.

Macle. See Andalusite (Chiastolite).

Macro-diagonal. The greater of the lateral axes in the rhombic system, also a plane parallel to this axis and the principal.

MAGNESITE.

[Carbonate of Magnesia.] Hexagonal; in rhombohedrons; with perfect rhombohedral cleavages, forming angles of 72° 31′; also massive; compact, reniform, earthy; tough or friable; fracture conchoidal or earthy; transparent to opaque; lustre vitreous; shining to dull; colourless, white, yellow, brown, or black; streak lighter than colour; H. 4·5-5, except earthy varieties; G. 2·8-3·1.

B., etc. In matrass no change, or loses colour; on C infusible, loses colour, becomes alkaline; turns reddish with Co; soluble with effervescence in HCl, HNO_3, or H_2SO_4.

Comp. Anhydrous carbonate of magnesia. Pure specimens contain—Carbonic anhydride 51·62 per cent., magnesia 48·38. With this composition the formula may be written $\dot{M}g\ddot{C}$ or $MgCO_3$ or COMgo".

Loc. From veins of serpentine in the Lizard district (impure). "An amorphous mineral of snowy whiteness, and occasionally pulverulent, from West Grambler, has been pronounced to be carbonate of magnesia, but hitherto this fact has not been confirmed." (J. Garby,

Trans. Roy. Geol. Soc. Corn., VII., 81.) Found also in Norway, Germany, India, &c.

Obs. It usually occurs in serpentine districts. It may be distinguished from calcite by its *solubility* in H_2SO_4, and by its behaviour when treated with Co.

Magnetic Iron Ore. See Magnetite.

Magnetism. A property possessed by many minerals containing iron, and in a less degree by those containing Ni and Co, especially after heating on C.

MAGNETITE.

[Magnetic Iron Ore. Oxidulated Iron.] Cubic; usually in modified octahedrons or rhombic dodecahedrons, &c. (Figs. 1, 2, 3, 8, 10, 14, 15, 29, &c.); often maculed; also compact, granular, lamellar, disseminated, or earthy; brittle; uneven or conchoidal; opaque; lustre metallic or sub-metallic; splendant to dull; iron-black or dark brown; streak like colour; H. 5·5-6; G. 4·9-5·2; magnetic, especially when massive.

B., etc. In matrass no change, or turns red; on C infusible. or fuses with very great difficulty, and often loses its magnetism somewhat; with borax gives Fe reactions; soluble in warm HCl or HNO_3.

Comp. Anhydrous proto-peroxide of iron. A pure specimen contains of protoxide of iron 35·03, peroxide of iron 68·97, or iron 72·41, oxygen 27·59. With this composition the formula may be written $\dot{F}e\dddot{F}e_2$ or Fe_3O_4 or Fe_2O_2Fe''.

Loc. Botallack, Crown's Rock, and the cliffs near by, massive, in bands or veins, with garnets, hornblende, axinite, epidote, and other rare minerals, also as a black magnetic sand; St. Michael's Mount; the Lizard, in hornblende; Gwinter, in diallage rock; Trelus-well, near Penryn, with green chlorite; Tresavean, massive, in chlorite; near Redruth, crystallized; Huel Jane, Kea; St. Agnes, in slate; Huel Maudlin; Lanlivery, with pyrites and garnet; Roche; Fowey Consols, with chalcopyrite and francolite; St. Stephens; Buckland-in-the-Moor, near Ashburton; Haytor, with hornblende and felspar; Hatherby, near Ilsington; South Brent; near Tavistock; in veins at Lundy Island, &c.; found also in Scotland, Iceland, Norway, and many foreign localities, in large quantities.

Obs. Massive magnetite may be distinguished from hematite by its *black* streak; crystallized specimens may be distinguished by form alone.

Angles. The same as in Cuprite.

o o = 109° 28′ d d = 120° 00′
a a 90 00 &c.

MALACHITE.

[Green Carbonate of Copper.] Oblique; crystals minute, and like Figs. 155, 156, 157; perfect cleavage parallel to M; usually massive, globular, reniform, botryoidal, mammillated, stalactitic; compact, fibrous, or earthy; brittle; fracture sub-conchoidal or uneven; translucent to opaque; lustre adamantine or vitreous; often dull; various shades of green; crystals dark green; globular masses usually banded in concentric layers of different shades; streak light green; H. 3·5-4; G. 3·7-4.

B., etc In matrass gives off water and turns black; often decrepitates; on C infusible and turns black; in RF yields a globule of Cu; more readily on addition of soda; with borax yields Cu reactions; soluble with effervescence in HCl or HNO_3 (dilute), forming a blue solution; slowly turns ammonia blue.

Comp. Hydrated carbonate of copper. Pure specimens yield nearly 71·91 per cent. of oxide of copper, 19·90 per cent. of carbonic anhydride, and 8·19 per cent. of water. With these proportions the formula may be written $\dot{C}u\ddot{C} + \dot{C}uH_2$ or $CuCO_3 + CuH_2O_2$ or $COCuo'' + CuHo_2$.

Loc. Botallack, Huel Cock, Huel Edward, Huel Speed, and other mines in St. Just; Huel Alfred, Phillack; St. Michael's Mount, in small specks; West Godolphin, Breage; Mullion; various parts of the Lizard district, with native copper; Dolcoath and other Camborne mines; Huel Buller, Huel Basset, South Huel Basset, and other mines near Redruth; Huel Gorland, Ting Tang, Carharrack, and many other mines in Gwennap; Huel Husband; West Huel Virgin; Huel Music; Huel Mexico; Hewas; Huel Harmony; Lanescot; Pentire, in acicular crystals; Phœnix; Gunnislake; Buckfastleigh; Hennock, near Chudleigh; Combemartin, and other places in Devon, in small quantities.

Obs. Malachite occurs in *small* quantities in the older workings of almost all the copper mines of the two counties. The crystals are usually found lining cavities in the massive specimens. It may be distinguished from chrysocolla by its superior sp. gr., hardness, and abundant effervescence, and ready solution when treated with dilute HCl.

Angles.

M M′	= 123°	35′	M e =	112°	33′
O M	90	00	e e	107	16
O T	90	00			

Malleable. Capable of being beaten into thin plates. *Ex.* Gold, Silver, Copper.

Malleable Copper. See Native Copper.

Mammillary. See Form of Minerals.

Manganese Spar. See Rhodonite.

MANGANITE.

[Grey Oxide of Manganese.] Rhombic; in prisms vertically and deeply striated (Fig. 110); often grouped in bundles, with perfect brachydiagonal cleavage; also massive, fibrous, radiating, compact, granular; brittle; fracture uneven; translucent on thin edges to opaque; metallic or sub-metallic, often splendant; dark steel-grey to iron-black; streak brown or black; H. 3·5-4; G. 4·2-4·4; perfectly conducts electricity.

B., etc. In matrass gives off H_2O; on C is infusible; with soda, borax, and micro. gives Mn reactions; soluble in warm HCl.

Comp. Hydrated manganic peroxide. Pure specimens yield 89·90 per cent. of peroxide of manganese, and 10·10 per cent. of water. With this composition the formula will be $\dot{M}n_2\dot{H}_2$ or $Mn_2O_3H_2O$ or $Mn_2O_2Ho_2$.

Loc Botallack, in brilliant crystals; Huel Bucketts; Veryan; Indian Queens, near St. Columb; Trebartha; St. Minver, well crystallized; Lettcott; Lanlivery; Restormel (acicular); Upton Pyne, near Exeter (well crystallized); Doddiscombleigh, near Chudleigh; in North Devon; in West Devon, in sandstone. The mineral occurs well crystallized in Scotland, Ireland, and in many foreign parts.

Obs. It may be readily distinguished from Pyrolusite by its lustre and hardness; from the ores of copper and antimony by its infusibility.

Angles.

M M′	= 99°	40′	k k =	103°	24′
M O	90	00			

MARCASITE.

[White Iron Pyrites.] Rhombic; in modified prisms (Figs. 150, 151, 152, &c.); often macled; crystals usually striated, sometimes rough; often stalactitic, botryoidal, reniform, radiating; brittle; fracture uneven; opaque; lustre metallic, splendant to dull; pale yellow, greenish, greyish, often a brown tarnish; streak dark greenish-grey; H. 6-6·5; G. 4·6-4·9.

Var. a. Cocks-comb Pyrites is a macled variety, which occurs in forms resembling Fig. 152.

b. Lonchidite is a similar variety, containing a little (2 to 6 per cent.) arsenic. It is tin-white, greyish, or greenish-grey.

c. Hepatic Pyrites is a partly decomposed variety, of liver-brown colour.

B., etc. In matrass gives a deposit of S; on C melts readily to a dark magnetic bead, gives off a sulphureous odour; insoluble in HCl; soluble in strong HNO_3, leaving a deposit of S.

Comp. Anhydrous sulphide of iron. The following analysis of a specimen of Lonchidite from Cook's Kitchen is by Platnner:—

Sulphur	49·61
Iron	44·23
Arsenic	4·40
Cobalt	0·35
Copper	0·75
Lead	0·20
Total	99·54

With iron 46·67 per cent., sulphur 53·33, or the same as ordinary iron pyrites, the formula may be FeS_2.

Loc. Cook's Kitchen and Tincroft (Lonchidite), on brown iron ore and pyrites; Huel Unity; Creegbrawse; Huel Clifford; Huel Rose, Newlyn; Fowey Consols; Huel Crowndale; Huel Crebor (Lonchidite, in a tle heaps); Virtuous Lady Mine, aggregated crystals, very large, on quartz; Combemartin; Tamar Mines, near Beerferris (formerly in hexagonal prisms, pseudo after calcite); found also in Cumberland, Scotland, Ireland, and many foreign localities.

Obs. It is best distinguished from Pyrites by its crystalline form, paler colour, and greater liability to spontaneous decomposition.

Margarodite. See Gilbertite.

Marmolite. See Serpentine.

Martial Arseniate of Copper. See Scorodite.

Martial Pyrites. See Pyrites.

Massive. Regular structure, but no distinct external form.

Matrass. A small vessel of glass with a bulb blown at one end; a bolt head; a simple tube closed at one end, used in the testing of minerals by the aid of heat. Two such tubes may be made from a piece of glass tube about four inches long and one-sixth wide, by softening the centre in a gas flame or candle flame, with the aid of a blowpipe, and then pulling the ends asunder. For the method of using such tubes see Blowpipe Reactions.

Meagre. Minerals which feel soft and rough are so called; the word is used in contra-distinction to *harsh* (hard and rough) and *unctuous* (soft and smooth).

MELACONITE.

[Black Copper Ore.] Amorphous? cubic? oblique? usually massive, pulverulent, earthy, or investing; friable; opaque; dull; dark grey to black; streak black and shining, or dull; soils the fingers; H. below 1·5(?) G. 5·2.

Var. "Melaconite crystals from Cornwall, collected by Mr. Talling, have been described by Maskelyne as 'monoclinic,' . . 'basal cleavage easy,' . . . 'often twins,' . . 'H. a little above 4; G. 5·825-827; Church has ascertained that the crystals are essentially pure CuO.' It would appear . . that this oxide of copper is trimorphous." (Dana, Syst. Min., 1868.)

B., etc. In matrass usually gives off some water; on C is reduced to malleable copper where it touches the support; pure specimens are easily reduced to a bead; with borax or micro. gives Cu reactions; with soda an indication of Mn is often obtained; soluble in HCl or HNO_3, forming a green solution; slowly soluble in ammonia, forming a deep blue solution.

Comp. Anhydrous oxide of copper, often containing silica, manganese, and a little water. Pure specimens contain copper 79·85 per cent., oxygen 20·15 per cent. With these proportions the formula will be Cu or CuO.

Loc. Botallack, Huel Speed, and other St. Just mines; Huel Trenwith; Huel Providence; Marazion Mines; West Godolphin; Great Huel Vor; Great Huel Fortune; Huel Herland; Relistian; Tresavean; Ting Tang; Huel Jewell; United Mines; Huel Basset; Huel Buller; Huel Trefusis; Dolcoath; Tincroft; Huel Seton; Great St. George, Perranzabuloe; Pembroke; East Crinnis; Fowey Consols; Gunnislake; and in small quantities in most of the copper mines of the two counties, with other ores of copper, of which it is, perhaps, a decomposition product. It occurs in copper mines and gozzans, under similar circumstances, all over the world.

Obs. It may be easily distinguished from wad, asbolane, and pyrolusite by its yielding a bead of copper on C before the blowpipe. From pitchblende by the same reaction, and by its softness.

MELANTERITE.

[Copperas. Green Vitriol. Sulphate of Iron.] Oblique; in prisms, with angles of 97° 39′ and 82° 21′, with perfect basal cleavage; usually botryoidal, reniform, stalactitic, pulverulent, incrusting, or massive; brittle; conchoidal or uneven; translucent to opaque; vitreous; various shades of green, with a yellow or brown tarnish; streak white; H. 2; G. 1·8-1·9; taste metallic and inky.

B., etc. In matrass fuses, swells up, and gives off water, which reddens blue litmus paper, leaving a yellowish infusible residue; on C the same; gives off SO_2; finally turns red and magnetic; with borax gives Fe reactions; soluble in H_2O, forming a pale green solution, which gives a rust-coloured precipitate with ammonia.

Comp. Hydrated sulphate of iron. Pure specimens yield 27·19 per cent. of oxide of iron, 31·02 per cent. of sulphuric anhydride, and 41·79 per cent. of water. With these proportions the formula may be written $\dot{Fe}\dddot{S}+7H_2$ or $FeSO_4+7H_2O$ or $SO_2Fe''+7OH_2$.

Loc. Huel Prosper, in irregular nodular or semi-crystalline masses; St. Agnes; Ting Tang; United Mines; Fowey Consols, Huel Maudlin; and the old workings of many other mines in Cornwall, in small quantities. Found also in similar circumstances in most mining districts.

Obs. It is probably produced by the decomposition of pyrites or marcasite. Distinct and well-formed crystals seldom occur in nature.

Menaccanite. See Ilmenite.

MESOLITE.

[Harringtonite. Antrimolite. Mealy Zeolite.] Anorthic (?); two perfect cleavages = 88° and 92°; in acicular aggregations, the crystals always macled; in divergent groups or delicate tufts, lateral planes being indistinctly striated; also massive, fibrous, columnar, drusy, compact, porcellanous, &c., fragile; tough when amorphous; transparent to opaque; lustre vitreous or silky; white, colourless, greyish, yellowish; H. 3·5-5·5; G. 2-2·4.

Var. a. Antrimolite is a variety; with H. 3·5-4; G. 2-2·1.

b. Harringtonite has H. = 5·25; G. 2-2·1; it occurs massive, earthy, and tough.

B., etc. In matrass gives off much water; on C becomes opaque, if not so already; swells up into a vermicular mass, and fuses to a blebby enamel; decomposed by HCl, depositing gelatinous silica.

Comp. Hydrated silicate of lime, alumina, and soda. The composition of

the Irish, Scottish, and foreign specimens hitherto analysed is from 45·0 to 49·0 per cent. of silica, 25·0 to 28·0 per cent. of alumina, 5·0 to 11·0 per cent. of lime, 4·0 to 8·0 per cent. of soda, and 10·0 to 13·0 per cent. of water.

Loc. The rocks between Botallack and Huel Cock, with axinite and natrolite, as a mealy deposit; Stenna Gwynn. It occurs also in Ireland, Scotland, Iceland, and many foreign localities.

Obs. It is usually associated with volcanic rocks.

Meteorites. A meteorite of 23lbs. weight fell at Stretchley, in the parish of Ermington, about 12 miles from Plymouth, in the year 1623. (Trans. Devon. Assoc., vol. III.) Another meteorite fell at Menabilly, Cornwall, in 1791. (Greg and Lettsom, p. 246.)

Mica. This term, which was formerly applied to almost all minerals which could be split into thin folia, is now made use of only as a convenient term for a group of complex mineral silicates having many properties in common.

a. They are all characterized by a perfect and easily obtained basal cleavage; so that they are readily reduced to thin, tough laminæ, with usually a pearly or submetallic lustre.
b. Potash is almost always present among the protoxide bases, and alumina among the peroxides.
c. The crystallization is either rhombic or hexagonal, the angle formed by any two adjacent prismatic faces being 120°.

The Micas described in this Handbook are—

Gilbertite, *Lepidomelane*,
Lepidolite, *Muscovite*.

Micaceous Iron Ore. See Hematite.

Micaceous Uranium Ore. See Autunite and Torbernite.

Microcosmic Salt. This very useful salt, a phosphate of soda and ammonia, is largely used in the blowpipe examination of minerals. The colours of its beads, formed with various metallic oxides, are sometimes different to those produced with borax, and it affords a ready means of detecting silica, which is soluble in borax but not in "micro."

MILLERITE.

[Sulphuret of Nickel. Haarkies.] Hexagonal; in six or twelve-sided capillary, acicular, or divergent filaments; brittle; opaque; lustre metallic; various shades of yellow; often a grey or iridescent tarnish; streak like colour; H. 3-3·5; G. 5·2-5·3.

B., etc. In matrass gives off SO_2 and a yellow sublimate; on C fuses, boils, forms a black magnetic mass; with borax gives Ni reactions; insoluble in HCl; soluble in warm HNO_3; more readily in Aqua Regia, forming a green solution.

Comp Anhydrous sulphide of nickel. With nickel 64·86 and sulphur 35·14, the formula may be written NiS. No analysis of a British specimen is known to the author.

Loc. Huel Sparnon, in capillary and divergent fibres of a dull yellow colour; Pengelley Mine, St. Ewe; Huel Chance; Fowey Consols; Combemartin, and near Ilfracombe, in minute filaments lining cavities, and dispersed among crystals of galena. Found also in Wales, Scotland, Ireland, Germany, &c., but everywhere a rare mineral.

MIMETITE.

[Arseniate of Lead. Mimetesite. Kampylite.] Hexagonal, in regular six-sided prisms, often terminally modified (Figs. 188 and 190), or with curved faces; also fibrous; mammillary; sectile or brittle; imperfectly conchoidal or uneven; translucent, resinous, or pearly; yellowish, greenish, often a brown tarnish; streak white, or nearly so; H 3·5-4; G. 7·0-7·3.

Var. a. Kampylite, or Camphyllite, is a yellowish-brown variety, which occurs in crystals with convex faces (barrel-shaped).

b. Hedyphane is a white variety.

B., etc. In matrass gives a white sublimate; on C fuses readily; forms a white incrustation, yields an arsenical odour, and finally a bead of Pb with R flame; more readily on addition of soda; decomposed by strong HNO_3, and by KHO.

Comp. Anhydrous arseniate of lead, with some chloride of lead. The following analysis of a specimen from Huel Unity was made by Mr. Gregor, in 1809:—

Arsenic anhydride	26·40
Oxide of lead.....	69·76
Chlorine	1·58
Total.....	97·74

An analysis of a Cornish specimen by Dufrenoy was equal to 84·55 per cent. of arseniate, 4·5 per cent. of phosphate, and 9·05 of chloride of lead. With arseniate of lead = 90·66 and chloride of lead 9·34, the formula might be $PbCl_2 + 3Pb^3As_2$ or $3As_2O_3Pbo''_3 + PbCl_2$. With arsenic anhydride 23·2, oxide of lead 67·5, and chloride of lead 9·3 the formula might be $As_2O_3Pbo''_4\ (^{O}_{Cl}\ Pb'')$.

Loc. Huel Unity, formerly, in very fine thick light brown translucent crystals, on galena, some more than three-quarters of an inch long, also acicular; Huel Alfred, in the year 1824 fine crystals of Mimetite were here first discovered, in a cross lode; "the crystals are splendant, of a rich topaz colour;" "some of the crystals § of an inch in length, and ¼ of an inch in diameter" 'Mem. of Min., Truro, 1825); Huel Gorland, fine yellow crystals, on quartz; Huel Rose and Huel Penrose, Sithney; Huel Prosper; Penberthy Croft; Huel Boys, Endellion; North Downs Mine; Beeralstone, with other ores of lead. Found also in Cumberland, Durham, Yorkshire, and most lead mining districts.

Obs. It usually has part of its arsenic anhydride replaced by phosphoric anhydride.

Mineral. Any *natural, homogenous, inorganic* body! The word is used in this sense throughout this Handbook. Rocks are often composed of mixtures of minerals, more or less impure. *Ex.* Granite, The science which treats of minerals may be conveniently sub-divided into—

a. DETERMINATIVE MINERALOGY, including the chemistry of minerals.
b. DESCRIPTIVE MINERALOGY, including the sub-science of crystallography.
c. SYSTEMATIC MINERALOGY, or the arrangement of minerals into classes and systems.
d. DISTRIBUTIVE MINERALOGY, or their geographical distribution.
e. PARAGENETIC MINERALOGY, or their mutual association in lodes and rocks.

Mineral Pitch. See Bitumen.

MISPICKEL.

[Arsenical Iron. Arsenical Iron Pyrites.] Rhombic; in prisms or pyramids (Figs. 90 to 93, &c.); often striated, curved, rough, or macled; also acicular, or massive, columnar, radiated, fibrous; or disseminated; brittle; fracture uneven; opaque; lustre metallic, often glimmering only; tin-white to steel-grey; streak blackish-grey; H. 5·5-6; G. 6-6·3.

B., etc. In matrass a red sublimate; on C fuses to a dark magnetic globule, giving a yellow incrustation, and a sulphureous and arsenical odour; soluble, except the sulphur, in strong HNO_3, more readily in Aqua Regia.

Comp. Anhydrous sulpharsenide of iron. With iron = 34·37 per cent., sulphur 19·64, and arsenic 45·99 the formulæ FeS_2+FeAs_2, FeSAs or $Fe_2S_2As_2$ may be used.

Loc. Botallack, Huel Castle, Levant, and other St. Just mines; Penzance hill; Wherry Mine; Huel Mary and Providence, Lelant (containing silver); St. Ives Consols; West Poldice; New Rosewarne; Huel Herland, Huel Unity, Relistian, in chlorite, and other mines in Gwinear; Huel Vor, Breage; Carn Camborne, Dolcoath, Cook's Kitchen, Tincroft, Carn Brea, East Pool, and other mines in Camborne and Illogan; Huel Tolgus; South Tolgus; the United Mines; Huel Jewell; Great Hewas United; Huel Maudlin; Holmbush; Devon Great Consols; Virtuous Lady (fine crystals, imbedded in chlorite); Tamar Mines, near Beerferris (fine crystals); Ivy Tor Mine, near Okehampton; and many other localities in the two counties. It is a very common mineral in many mining districts in Cumberland, Scotland, and abroad.

Obs. A large quantity of the white arsenic of commerce is obtained from this mineral, which is largely associated with the tin and copper ores throughout the district. A great deal of arsenic is, however, in some mines obtained from Leucopyrite.

Angles.

M M =	111°	22′	r r′ =	33°	32′
M O	90	00	e e	120	48
l l′	100	38	s l	159	50
s s′	62	08			

Mock Lead. An old name for Blende.

Modified. Crystals which have small planes in place of their solid angles or edges are said to be *modified*; thus Fig. 8 is an octahedron, modified by planes of the cube; Fig. 9 a cube, modified by planes of the octahedron, &c.

MOLYBDENITE.

[Sulphuret of Molybdena. Molybdena Glance.] Hexagonal; in small crystals like Fig. 223, in irregular flat tables with perfect basal cleavage; foliated, massive, or scaly; flexible, but not elastic; opaque; lustre metallic; colour like freshly-cut lead; streak greenish-grey; marks paper like plumbago; unctuous; H. 1-1·5; G. 4·4-4·8.

B., etc. In matrass unchanged; on C infusible, but gives off SO_2 and burns away, colouring the flame green, except a small ash, which gives Mn or Fe reactions with soda and borax; effervesces when fused with soda; insoluble in warm HCl or HNO_3; soluble in strong H_2SO_4, forming a blue solution.

Comp. Anhydrous sulphuret of molybdenum. Pure specimens yield 59·13

per cent. of molybdenum and 40·87 per cent. of sulphur, the formula being MoS_2.

Loc. Huel Mary, Lelant; Huel Friendship; Huel Unity, and other mines in Gwinear; Huel Gorland, and other parts of Gwennap, in elvan; Menabilly; Drakewalls Mine, Calstock. It is also found in Cumberland, Scotland, and many foreign localities. It has been found in slags from copper smelting works.

Obs. It may be distinguished from graphite by its superior sp. gr., blowpipe reactions, and the colour of its streak on porcelain.

Mountain Cork, Mountain Paper, Mountain Leather, Mountain Wood. See Amphibole.

Mundic. See Pyrites.

Murchisonite. See Orthoclase.

Muriate of Copper. See Atacamite.

Muriate of Silver. See Kerargyrite.

MUSCOVITE.

[Mica. Potash Mica.] Oblique (?); or Hexagonal (?); sometimes occurs in prisms, but more usually in tables like Figs. 239 to 241, or irregularly-shaped scales, or massive; cleavage perfect and easily obtained, basal; thin plates flexible and elastic; tough; lustre pearly or sub-metallic; white, grey, brown, yellow, &c.; often dichroic; translucent; thin plates transparent; streak white or greyish; H. 2-3; G. 2·8-3 1.

B., etc. In matrass unchanged, but usually yields traces of HF; on C some varieties are readily fusible to an opaque or glassy enamel; insoluble in HCl or H_2SO_4.

Comp. A complex silicate of alumina, iron, potash, &c.

Loc. St. Dennis, near St. Austell. Probably most of the mica of the Cornish and Devonshire granites belongs to this species, but as crystals are rare it will probably be necessary in any future close examination of these micas to distinguish them by their optical properties. The chemical constitution of the micas seems too varied to form the basis of a subdivision, as least at present.

Angles.

M M′ =	120°	46′	o b =	90°	00′
M O	98	40	o r	107	05
M b	119	38	b x	148	30

That there is still some confusion as to the species, is seen in the fact that, although the above angles are given as those of muscovite, Descloiseaux states that its crystals are right rhombic prisms of 120°, or just the same as Lepidolite and Lepidomelane.

N.

Nacrite. See Gilbertite.

Nail-headed Copper Ore. See Chalcocite.

Native Arsenic and other metals. See the metals.

Native Loadstone, Native Magnet. See Magnetite.

NATROLITE.

[Needle Stone. Mesotype. Zeolith.] Rhombic, in slender or acicular prisms, like Figs. 112 and 113, with perfect longitudinal cleavages; also mammilated, massive; fibrous or radiating; brittle; fracture conchoidal or uneven; transparent or translucent, occasionally opaque; lustre vitreous or silky, pearly on cleavage planes; white, yellowish, greyish, greenish, or brown; streak white; H. 5-5·5; G. 2·2-2·3.

B., etc. In matrass gives off water; on C fuses readily, often boiling; colours the tip of the flame yellow; the white residue treated with Co turns blue; decomposed readily by HCl or oxalic acid, depositing gelatinous silica.

Comp. Hydrated silicate of soda and alumina. The Cornish specimens are not known to have been analysed, but foreign specimens yield about 48·6 per cent. of silica, 27·7 per cent. of alumina, 16·6 per cent. of soda, and 9·7 per cent. of water. With these proportions the formula may be written $\dot{N}a_2\ddot{S}i + \ddot{A}l_2\ddot{S}i + 2\dot{H}_2$ or Si_3O_2 $Al_2{}^{vi}Na_2 + 2OH_2$.

Loc. The rocks between Botallack and Huel Cock, and at Huel Carne, with Prehnite and Stilbite. Said to have been found also at Stenna Gwynn. It is also found in Ireland, Scotland, and many volcanic districts abroad.

Obs. It is one of the very rarest British minerals.

Angles.

M M′ =	91°	00′	o o =	143°	20′
M O	116	40			

Needle Spar. See Aragonite.

Nephrite is said to have been found in the Lizard district, but the specimens were probably Saussurite.

NICCOLITE.

[Kupfernickel. Copper Nickel. Arsenical Nickel.] Hexagonal; usually massive and compact; also reticulated, arborescent, reniform, or columnar; brittle; fracture uneven; opaque; lustre metallic; pale copper red, often with a greyish or blackish tarnish; streak pale brownish-black; H. 5-5·5; G. 6·6-7·3.

B., etc. In matrass gives a faint white sublimate; in open tube turns yellowish-green, and yields a white crystalline sublimate; on C fuses easily to a globule, giving off strong arsenical odours; with borax yields reactions for Fe, Co, Ni, &c.; soluble in Aqua Regia, forming a green solution.

Comp. Anhydrous arsenide of nickel. With arsenic = 55·98 per cent. and nickel 44·02 the formula might be written NiAs.

Loc. Huel Chance, St. Austell, with Millerite; Fowey Consols, formerly, in the 200 fathom level; Pengelly Mine, St. Ewe, massive, and in fine fibres; Black Down, Devon, with Rhodonite and Psilomelane. Found also in Scotland, Germany, France, and many other foreign localities.

Obs. It may be easily distinguished from native copper, which it often somewhat resembles in colour, by its hardness and brittleness.

Nickel Ochre. See Annabergite.

Noble Metals. Those metals the oxides of which can be reduced by heat alone, without the use of carbon or fluxes. *Ex.* Gold, Silver, Mercury, Platinum.

Nodular. Occurring in nodules.

Nodule. An irregular rounded mass.

O.

Oblique Prismatic Arseniate of Copper. See Clinoclase.

Ochre. See Hematite and Limonite.

Octahedral Arseniate of Copper. See Liroconite.

Octahedral Cobalt Pyrites. See Smaltite.

Octahedral Copper Ore. See Cuprite.

Octahedral Copper Pyrites. See Erubescite.

Octahedral Iron Ore. See Magnetite.

Octahedron. A solid figure having eight sides. In the regular octahedron these are equal equilateral triangles (Fig. 1).

Odour. A character of some value in the discrimination of minerals in a few instances. Thus, many substances containing alumina give off a peculiar "earthy" smell when breathed upon or broken. Many ores containing sulphur or arsenic give off peculiar odours when broken or rubbed, as is also the case with some varieties of quartz, calcite, barytes, &c.

OLIVENITE.

[Olive Copper Ore. Olive Malachite. Right Prismatic Arseniate of Copper. Pharmacochalcit.] Rhombic; in prisms variously modified (Figs. 136, 137, 138); the planes often curved, striated, or rough; more usually reniform, stalactitic, fibrous, or capillary; or massive, nodular, granular, or earthy; brittle; fracture conchoidal or uneven; lustre adamantine, vitreous, resinous, or silky; shining to glimmering; various shades of greyish or brownish-green; streak like the colour, but lighter; H. 3; G. 3·9-4.

Var. Wood arseniate is a fibrous concentric variety, with but little lustre, and often almost ash-coloured.

B., etc. In matrass gives off water and turns darker; on C fuses at 1 to a dark globule, which crystallizes on cooling; sometimes deflagrates; deposits an abundant white incrustation on the cool part of the charcoal support; gives off a strong arsenical odour; with soda yields a malleable bead of copper; soluble in HNO_3, and partially so in ammonia, forming a blue solution.

Comp. Hydrated arseniate of copper. The following are analyses of Cornish specimens, a. by Von Kobell, a massive specimen; b. and c. by Richardson, massive and acicular; d. by Damour, sp. gr. 4·378; e. by Hermann, sp. gr. 4·135:—

	a.	b.	c.	d.	e.
Arsenic anhydride	36·71	39·9	39·80	34·87	33·50
Oxide copper	56·43	56·2	56·65	56·86	56·38
Phosphoric anhydride	3·36	—	—	3·43	5·96
Water	3·50	3·9	3·55	3·72	4·16
Total	100·00	100·0	100·00	98·88	100·00

The following analyses perhaps point to a different composition; f., a fibrous specimen, by Hermann, G. 3·913; g., by Thomson, fibrous; h., by Klaproth:—

	f.	g.	h.
Arsenic anhydride	40·50	40·61	45·00
Oxide of copper	51·03	54·98	50·62
Phosphoric anhydride	1·00	—	—
Oxide of iron	3·64	—	—
Water	3·83	4·41	3·50
Total	100·00	100·00	99·12

With arsenic anhydride 40·6 per cent., oxide of copper 56·3 per cent., and water 3·1 per cent. the formula may be written

$4Cu, As_2, H_2$ or $Cu_3As_2O_8 + CuH_2O_2$ or $As_2O_5Cu''_3 + CuHo_2$.

Loc. Huel Unity, Huel Gorland, Ting Tang, Carharrack, and other mines in Gwennap (most varieties); Huel Buller;

Pednandrea; Tincroft; Beam Mine; Phœnix; Gunnislake; Bedford United Mines, near Tavistock, in olive-green prismatic crystals, also fibrous and acicular. It is found also in Cumberland, and many foreign localities.

Obs. It will be seen that, as is frequently the case with arseniates, a small proportion of the arsenic anhydride is replaced with phosphoric anhydride. The massive varieties may be distinguished from other arseniates of copper by their olive-green or ash-grey colour. Crystals may be known by their forms.

Angles.

M M′ =	92°	30′	a b =	90°	00′
M b	136	15	v b	125	46
M a	133	45	e a	124	35
e e′	69	10			

The combinations most frequently seen are M e, M e b, M e b a, M e b a v. The faces e and a are frequently uneven.

OPAL.

Amorphous; massive, reniform, stalactitic, &c.; brittle; fracture conchoidal, even, or uneven; transparent to translucent on edges; lustre vitreous, resinous, or pearly; colourless, milk-white, grey, red, brown, blue, green; often a play of colours as the specimen is moved about; streak white; H. 5·5-6·5; G. 1·9-2·3.

Var. a. Common Opal is semi-transparent, and the colours are dull.

b. Semi-opal is similar, but less transparent, and with still duller colours.

c. Ferruginous Opal (Eisenkiesel or Iron-flint) is a highly ferruginous variety.

d. Wood-opal has the form and texture of wood, of which it is often a silicified variety.

e. Hyalite or Muller's Glass is vitreous, transparent, and colourless.

f. Fire-opal is transparent or semi-transparent; red or yellow, and iridescent.

g. Noble Opal is semi-transparent or translucent, of a milk-white, bluish, or yellowish-white colour, and exhibiting a beautiful play of colours.

h. Cacholong is white and opaque.

i. Hydrophane is nearly opaque when dry, but if immersed in water becomes nearly transparent.

B., etc. In matrass usually yields water; on C infusible; sometimes decrepitates, or turns red or opaque; with soda melts with much effervescence to an opaque or transparent bead; with micro. retains its form and appearance; insoluble in HCl, HNO_3, H_2SO_4, or Aqua Regia; the powder soluble in KHO.

Comp. Hydrated silica, with from 3·0 to 13·0 per cent. of water, and variable quantities of alumina, lime, magnesia, potash, soda, or oxide of iron.

Loc. 1. Common Opal.—Botallack, Huel Stennack, Huel London, Trewellard, the Bunny, and Huel Spearn, St. Just; Huel Spinster, Huel Damsel, and Huel Buller, near St. Day and Redruth; North Roskear, Camborne; Huel Rosewarne, Gwinear; Stenna Gwynn; Huel Sovereign, massive, blue and white, presented to Royal Institution of Cornwall in 1846; Trugoe; Huel Maudlin; Hay Tor; on Dartmoor; Lustleigh, &c.

2. Semi-opal occurs at most of the above localities, and especially near Okehampton, of a snow-white colour.

3. Wood-opal (silicified wood) occurs on the Blackdown-hills, Devon.

4. Ferruginous Opal occurs especially in the St. Just mines and near Camborne.

5. Fire Opal occurs, of a greyish-white colour, at Botallack; Rosewarne; Huel Spinster, and Huel Gorland (yellow), St. Day.

6. Cacholong, of a cream colour, on quartz and with steatite, from Botallack, is now in the Museum of the Royal Institution of Cornwall.

Obs. Opal may be distinguished from the different varieties of calcedony by the larger quantity of water given off when heated in a matrass, by its inferior hardness and gravity, and by its solubility in caustic potash. It is, however, possibly, only an extreme form of calcedony, which usually contains *some* water, and is *slightly* soluble in caustic potash.

The finest opals come from Mexico.

Opalescent. Resembling opal in lustre and texture; exhibiting a play of colours or iridescence, like fire-opal and noble opal.

Opaque. Substances through which light cannot pass are said to be opaque. The minerals having true metallic lustre, as Pyrites, Galena, &c., are the most opaque.

Ophiolite, Ophite. See Serpentine.

Optical Characters of Minerals. The chief of these are:—

1. Colour.
2. Lustre.
3. Diaphaneity.
4. Phosphorescence.
5. Fluorescence.
6. Refractive power.
7. Polarization.

Each of these are described under their respective heads.

ORTHOCLASE.

[Felspar. Potash Felspar. Orthose; &c.] Oblique; in prisms, often flattened, or variously modified (see Figs. 172 to 180); two perfect cleavages (basal and clinodiagonal, M., O.), making angles of 90° 00′; brittle; fracture conchoidal, uneven, or splintery; transparent to nearly opaque; vitreous to pearly; white, grey, red, green, brown, or black; streak white, greyish, or slightly tinted like the colour; H. 6; G. 2·5-2·6.

Var. a. Adularia is colourless and transparent; sometimes a little greenish, opalescent, or a faint play of colours; cross fracture conchoidal.

b. Moonstone is like Adularia, but contains bluish-white spots, which, when held to the light, appear pearly or silvery.

c. Murchisonite is a flesh-red variety, pale or deep in tint; viewed in an oblique direction it has gold, yellow, or silvery reflections on a *third* cleavage; a microscopic examination seems to indicate that it is a compound of Orthoclase and Albite.

d. Common Felspar. Colour very various, but often pink or reddish, and usually a not very brilliant lustre.

e. Erythrite. A flesh-red variety, containing 3 per cent. of magnesia.

f. Amazon Stone is a clear green cleavable variety.

g. Sanadin, or Ryacolite, occurs in glassy transparent crystals, mostly tabular. It is often associated with modern lavas or pumice.

h. Compact Felspar is an uncleavable variety.

i. Pitchstone is, perhaps, an amorphous variety, of dark pitchy appearance.

B., etc. In matrass not changed, or loses colour; on C fuses at about 4 to a blistered slag, or infusible; with borax dissolves slowly, with effervescence, to a clear glass; insoluble in micro.; insoluble in HCl and HNO_3.

Comp. Anhydrous silicate of potash and alumina, with small quantities of other bases. Of the following analyses a. and b. are Orthoclase, from Trewavas Head, Breage, by Professor Haughton, recently (a. from veins at foot of cliff, b. from granite at head of cliff); c. and d. of Orthoclase from the "Glass Mine," Roche, by Phillips (Phil. Mag. Feb., 1871); e. is an analysis of felspar from Dartmoor; f. of Murchisonite from Exminster, both by Prof. Church (Rep. Dev. Assoc., vol. II., p. 201); g. is Murchisonite, from Dawlish, by Phillips (Phil. Mag. vol. 1, 1814, p. 448):—

	a	b.	c.	d.
Water	0·40	0·40	0·83	0·50
Silica	63·60	63·20	65·00	65·33
Alumina	21·04	21·00	19·00	19·16
Ferric oxide	trace	trace	·50	·50
Lime	0·90	0·68	1·57	1·68
Magnesia	—	—	trace	trace
Potash	9·91	10·30	10·37	10·37
Soda	3·08	2·75	2·40	2·40
Total	98·93	98·33	99·67	99·94

	e.	f.	g.
Silica	65·61	65·27	68·60
Alumina	19·73	20·34	16·60
Potash	12·73	12·43	14·30
Soda	1·50	1·44	—
Lime	0·33	0·33	—
Magnesia	0·10	0·19	—
Total	100·00	100·00	100·00

With silica 69·7 per cent., alumina 19·7 per cent., and potash 10·6 the formula may be written $6\dot{\dot{S}}i, \dot{K}_2, \dot{\dot{A}}l_2$ or $Al_2O_3 3Si O_2 + K_2OSiO_2 + 2SiO_2$ or $Si_6O_8Ko_2Al_2O^{vi}$. This last is the formula given by Professor Frankland. With silica 60·5, alumina 25·7, and potash 13·7, the formula might be $4\dot{\dot{S}}i, \dot{K}_2, \dot{\dot{A}}l_2$ or $Al_2O_3 3SiO_2 + K_2OSiO_2$ or $Si_4O_4Ko_2Al_2O^{vi}$.

Loc. 1. Adularia—Tintagel and Delabole, in slate; Kit-hill, Callington; said to have been found also in prisms at St. Just.

2. Moonstone is said to have been found at Gluvias Burnt-house, near Penryn.

3. Murchisonite—Heavitree, near Exeter; Exminster; Topsham; Jacobstowe; Crediton; and near Dawlish, in the red conglomerate; the finest masses are obtained on the coast between Teignmouth and Dawlish, often lying on the beach.

4. Common Felspar—Fine crystals or masses have been obtained at the Scilly Isles; Boscreagen Cove, near the Land's End, of a deep red colour; Pendeen Cove, in fine crystals imbedded in schorl rock; Botallack, Balleswidden, and many of the St. Just mines, in fine masses; Mulvra-hill, Sancreed; Morvah United Mines; Ding Dong, Madron; St. Ives Consols; Huel Mary, and other mines in Lelant; Lamorna Point, near Penzance; the Marazion Mines; Huel Darlington; St. Michael's Mount; Trewavas Head, Tremearne, and Great Huel Fortune, Breage, in granite; Huel Ann, Trumpet Consols, and many other mines in Wendron; Kynance; near the Old Lizard Head, in green talc; Coverack Cove, Huel Union, Towednack, and other places in the Lizard district; the United

Mines, Tresavean, Huel Fortune, and other mines in Gwennap; East Huel Crofty; Dolcoath; East Pool; Huel Coates, St. Agnes (in twin crystals, some converted into Cassiterite); Cligga Head, in a decomposing granite; near Truro, in beautiful pink crystals, in several elvans; St. Stephens, St. Austell Hill Mine, and other localities near St. Austell; Luxulyan; and a large number of other localities near the granite.

Birch Tor Mine; North Bovey; Hay Tor; Ivybridge, in altered Devonian slate, with Chiastolite; Bovey Tracey, in fine red crystals; Lundy Island, with rock crystal; and many other places.

5. Sanadin, or Glassy Felspar—Little Haldon-hill, near Teignmouth, in large crystals imbedded in porphry.

6. Pitchstone—Skewes, Crowan; Carn Brea; South Huel Basset.

Obs. Only the more remarkable localities of felspar are given above, or where it is obtained in very pure specimens. Felspar forms a large proportion of the widely-spread masses of granite in Cornwall and Devon. The only certain way to distinguish between massive orthoclase and albite is by analysis; but good indications may be obtained by observing the cleavages, and also by the blowpipe behaviour. See Albite.

Angles.

T T =	118°	54′	O x =	129°	41′
T O	112	16	O y	99	38
T M	120	36	M n	134	57
T n	95	14	M z	150	35
T x	110	40	M o	116	53
T y	134	19	o y	140	33
O M	90	00	o z	124	59

Orthodiagonal. That *lateral* axis which is at right angles to the principal in the oblique system; also a plane parallel to that axis and the principal. Thus, in Figs. 168, 169, the plane a. is orthodiagonal; in 170, 171, the plane T.

Oxide. A combination of an element with oxygen is so called. Those oxides which form *acids* by addition of water are also called *anhydrides* by many chemists.

Oxide of Antimony. See Valentinite and Senarmontite.

Oxide of Arsenic. See Arsenolite.

Oxide of Bismuth. See Bismite.

Oxide of Cobalt. See Asbolane.

Oxide of Copper. See Cuprite and Melaconite.

Oxide of Iron. See Magnetite, Hematite, Limonite, and Goethite.

Oxide of Lead. See Plumbic Ochre.

Oxide of Manganese. See Pyrolusite, Manganite, Psilomelane, and Wad.

Oxide of Tin. See Cassiterite.

Oxide of Tungsten. See Wolframite.

Oxide of Uranium. See Pitchblende and Zippæite.

Oxidising Flame. See Instructions for the Examination of Minerals before the Blowpipe in Part I., and "Blowpipe Reactions," p. 18, Part II.

Oxychloride of Copper. See Atacamite.

Oxydulated Iron. See Magnetite.

Oxygen Ratio. This is a term used to express the rates between the proportion of oxygen in base and acid in a compound containing both. The modern *unitary* theories of chemistry have, therefore, in some degree lessened the use of the expression; since, by these, salts are not looked upon as compounds of base and acid. The oxygen ratio is most referred to in speaking of silicates, and was formerly considered of great value in determining their specific value. Professor Dana, however, would seem to consider it of but little importance, as the following remarks shew:—"The felspar group is remarkable for its unity in crystallographic and all physical characters, evincing the profoundest isotypism, and yet the O ratio for the bases of silica varies from 1-1 to 1-3." (Syst. Min., 1868.) See also page 46, Part II. of this Handbook, under Felspar.

P.

Parti-coloured. When the colour of a mineral specimen is different in different parts this term is often used.

Peacock Copper. See Chalcopyrite.

Peach. A Cornish name for Chlorite.

Pearl Spar. See Dolomite.

Pechurane. See Pitchblende.

PENTLANDITE.

[Eisennickelkies. Sulphuret of Iron and Nickel.] Cubical, with octahedral cleavage; usually massive, granular, or imbedded; brittle; fracture uneven; opaque; lustre metallic; light bronze yellow or brownish; streak dark brown; H. 3·5-4; G. 4·6; not magnetic.

B., etc. In matrass gives a yellow sublimate; in open tube a strong sulphureous odour; on C fuses to a dark brittle bead; with borax and micro. yields iron reactions. Soluble in HNO_3, forming a greenish-yellow solution.

Comp. Anhydrous sulphide of iron and nickel. With iron 42·0 per cent., sulphur 35·9 per cent., and nickel 22·1 per cent. (which is very near Scheerer's analysis of a Norwegian specimen), the formula may be written $2FeS+NiS$.

Loc. Huel Jane, near Truro, about the year 1857, in large masses, associated with Vivianite.

Obs. Its general appearance, physical characters, and blowpipe reactions are not greatly different to those of Pyrrhotite (Magnetic Pyrites). It is not, however, magnetic like Pyrrhotite, and the considerable proportion of nickel may be easily detected by humid analysis.

Peroxide of Iron. See Hematite, Limonite, Goethite.

Peroxide of Tin. See Cassiterite.

Petroleum. See Bitumen.

PHARMACOSIDERITE.

[Cube Ore. Arseniate of Iron.] Cubic; in cubes usually modified (Figs. 2, 3, 9, 16, 49, 50), with some planes striated, others curved, or rough; rarely massive; brittle; fracture uneven or sub-conchoidal; translucent to opaque; lustre vitreous, adamantine, or greasy; various shades of green, often tarnished yellow or brown; streak pale green, yellowish, or brownish; H. 2·5; G. 2·9-3; pyroelectric.

B., etc. In matrass turns red, gives off H_2O and a whitish sublimate; on C fuses easily to a grey magnetic slag, yielding a very strong alliaceous odour; with borax and micro. gives Fe reactions; soluble in HCl or HNO_3.

Comp. Hydrated arseniate of iron. The following are analyses of Cornish specimens of "arseniate of iron," a. and b. by Chenevix, c. and d. by Berzelius:—

	a.	b.	c.	d.
Arsenic anhydride	31·0	33·0	38·00	40·20
Peroxide of iron...	45·5	27·0	40·56	39·20
Oxide of copper...	9·0	22·5	0·60	0·65
Silica	4·0	3·0	0·35	1·76
Phosphoric anhydride.....	—	—	0·70	2·53
Water	10·5	12·0	19·57	18·61
Total	100·0	97·5	99·78	102·95

With arsenic anhydride 41·7 per cent., peroxide of iron 38·7 per cent., and water 19·6 per cent., the formula may be written $\dddot{4}Fe_2, 3As_2, 18\dot{H}_2$ or $3(Fe_2As_2O_8 + 5H_2O) + Fe_2H_6O_6$ or $3(As_2O_2Fe_2O^{vi}5OH_2) + Fe_2Ho_6$. These formulæ agree pretty well with the analyses c. and d., but not with a. and b., which are, perhaps, some other mineral. As is usual, a part of the arsenic is replaced by phosphorus.

Loc. Formerly at Huel Jane, near Truro, in cubes, with the alternate angles replaced, some with all the angles and edges replaced; Huel Falmouth; Huel Unity, Huel Gorland, and Carharrack Mine Gwennap, with many ores of copper (some inferior specimens have lately been found on the burrows in this neighbourhood); Carn Brea Mine, in dark green or yellowish-green cubes; Botallack, Levant, and Huel Owles, St. Just, in crystals which were usually covered with a dark tarnish; Beam Mine, in rhombic dodecahedrons of a brilliant grass-green, bottle-green, or pale blue colour, the size of pins' heads (Man. of Min., Truro, 1825, p. 63); recently at Pednandrea, in fine green modified cubes.

Obs. This mineral is rarely found other than crystallized, and the crystals are usually very small, one-eighth of an inch being considered a good size.

Angles.

a a =	90°	00′	a o =	125°	16′
d d	120	00	o d	144	44
o o	109	28	o k	164	12
a k	109	28	k k	152	44
a d	135	00	d k	160	32

The forms 2, 3, 9, 16, 49, 50, are all Cornish, most of them being in Mr. Greg's collection.

Phosgenite. See Cromfordite.

Phosphates. Compounds of phosphoric anhydride with metallic oxides are so called, or phosphoric acid in which the hydrogen has been replaced by a metal.

Phosphates may often be detected by the green tint which they impart to a blowpipe flame, and especially if first moistened with H_2SO_4 and heated in OF. In the presence of copper and some few other bases this reaction is obscured, when very small quantities may be detected by the following method:—The material to be tested is finely powdered, mixed with five times its volume of a mixture of three parts carbonate of soda, one of silica, and one of nitre, and the whole fused on platinum foil. The fused mass is dissolved in water and filtered; to the clear liquid a few drops of a solution of carbonate of ammonia is added. The solution is then boiled, and silica separates as silicate of soda, which should be filtered off. Acetic acid is then added to the clear solution, slightly in excess, it is then boiled to expel carbonic anhydride, and a drop of solution of nitrate of silver added. If a yellow precipitate should fall after this treatment it is evidence of phosphorus.

Most arseniates contain at least traces of phosphoric anhydride. The phosphates found in the two counties are the following:—

Apatite,	*Churchite,*
Pyromorphite,	*Lunnite,*
Childrenite,	*Demidoffite,*
Vivianite,	*Torbernite,*
Beraunite,	*Autunite,*
Libethenite,	*Wavellite.*

Of these, Apatite and Pyromorphite are anhydrous; the rest are hydrous. In many of them traces of arsenic anhydride may usually be detected.

Phosphate of Cerium. See Churchite.

Phosphate of Copper. See Libethenite, Lunnite, Demidoffite, and Torbernite.

Phosphate of Iron. See Vivianite, Bersaunite, and Childrenite.

Phosphate of Lead. See Pyromorphite.

Phosphate of Lime. See Apatite.

Phosphate of Uranium. See Autunite and Torbernite.

Phosphorescence. When minerals appear *luminous* under certain conditions they are said to be phosphorescent. This property may be produced by—

1. Friction. *Ex.* Quartz (frictio-phosphoric).
2. Heat. *Ex.* Fluor (pyro-phosphoric).
3. Electricity. *Ex.* Apatite (electro-phosphoric).
4. Exposure to sunlight. *Ex.* Diamond, Calcite (helio-phosphoric?).

Phosphorite. See Apatite.

Physical Characters of Minerals. A convenient sub-division of the characters of minerals is into—

1. Physical.
2. Chemical.
3. Optical.

The chief physical characters are—

1. Form,
2. Cleavage,
3. Fracture,
4. Frangibility,
5. Hardness,
6. Specific gravity,
7. Magnetism,
8. Electricity.

PIGOTITE.

Amorphous; incrusting; brown; streak and powder yellow.

B., etc. In matrass gives off water; on C burns away slowly, leaving a small quantity of white ash, which, when treated with Co, turns blue; insoluble in water or alcohol; soluble in HCl (?).

Comp. A hydrated *Mudesite* of alumina, the formula of which is said to be

$$4Al_2O_3 + C_{12}H_5O_8 + 27H_2.$$

Loc. Some of the granite caves of the coast of Cornwall.

Obs. It can hardly be considered a *mineral*. It has been observed in places where the surface-water trickles down over the granite rocks. "The organic constituent of Pigotite is considered by James F. Johnston to be derived from the decay of the various plants which grow on the moist moorlands above, and which being carried by the waters into fissures in the granite beneath, combines with the alumina of the decomposed felspar, and when it reaches the air deposits itself over the roof and sides of the cavern in the form of layers, varying from two to three inches in thickness." (Bristow's Gloss. Min., p. 288.)

PINITE.

Rhombic; usually in six or twelve-sided prisms, sometimes with the terminal edges modified (Fig. 111); sectile or brittle; fracture uneven; translucent to opaque; dull, glimmering, or waxy; resinous or pearly; greyish, greenish, or dark brown; streak white or grey; H. 2-3; G. 2·7-2·9.

B., etc. In matrass gives off a little H_2O; on C loses colour, and fuses on thin edges to a blistered glass or enamel; with Co turns bluish; with borax yields Fe reactions; imperfectly decomposed by HCl.

Comp. No analysis of a British specimen is known to the author, but foreign specimens contain from 47·0 to 56·0 per cent. of silica, 25·0 to 29·0 per cent. of alumina, 7·0 to 8·0 per cent. of protoxide of iron, 6·0 to 10·0 per cent. of potash, and 2·0 to 8·0 per cent. of water. This composition differs scarcely at all from that of some Agalmatolites, with the exception of the iron.

Loc. Trewellard Cliff, St. Just; the high hills south of Trewellard, in granite (Trans. Roy. Geol. Soc. Corn., J. Carne, vol. ii); Nangisel Cove, Sennen; Mulvra-hill, near Sancreed; in the rocks to the east of Lamorna Cove, in small dark brown crystals, like Fig. 111; Tol Pedn Penwith; St. Michael's Mount; in imbedded crystals in an elvan running through St. Hilary and Breage, by Tregoning-hill, and in another running from Tregurtha to Praa Sands; these elvans are largely used for road material, and good specimens may sometimes be obtained in the heaps by the roadside; between St. Austell and Grampound, in an elvan running from Polgooth, by Trewithen, to Court Mill; found also in Scotland, and many foreign localities.

Obs. Dana includes Pinite with Agalmatolite and many other minerals in a group of hydrous alkaline silicates, related chemically and physically to serpentine. He observes that it occurs in pseudomorphous crystals after Iolite, Nephelite, Scapolite, Felspar, and Spodumene. Some of the Breage specimens have a bluish colour, and considerable lustre.

Angles.

M M′ =	119°	10′	a b =	90°	00′
M O	90	00	a d	150	25
M a	120	25	d d′	120	50
O r	132	12			

Sometimes a face r is observed in the crystals from Lamorna, which truncates the angle M O.

PITCHBLENDE.

[Uranium. Pechurane.] Cubic (?) or amorphous; botryoidal, reniform, massive, or disseminated; columnar, curved, lamellar, or granular; brittle; fracture uneven or small conchoidal; opaque; lustre metallic, sub-metallic, or dull; greyish, greenish, or brownish-black; H. 5·5; G. 6·4-7.

B., etc. In matrass no change; on C infusible; with borax gives a yellow bead in OF; greenish in RF; with micro. gives U reactions; insoluble in HCl; soluble in warm Aqua Regia, or hot HNO_3, forming a yellow solution.

Comp. Proto-peroxide of uranium. No analysis of a British specimen is known to the author. With uranium 84·78 and oxygen 15·22 the formula would be $\dot{U}+\dddot{U}_2$ or U_3O_4.

Loc. Huel Edward, St. Just (many years ago and again recently); Botallack, formerly; Huel Trenwith; Huel Providence; Wherry Mine; Tincroft, with autunite; Huel Basset; Huel Buller; Tolcarne; Ting Tang; Pednandrea (mammillary); Roskrow United, Ponsanooth; St. Austell Consols; Treemoor, Withiel; found also in Norway, Sweden, Germany, and many other foreign localities.

Obs. It may be distinguished from blende by its sp. gr. and fracture; from wolfram by its fracture and streak. It is used for enamel painting, colouring glass for optical purposes, &c. It is often associated with ores of silver, lead, and copper.

Pitch Ore. See Pitchblende.

PITTICITE.

[Pitchy Iron Ore.] Amorphous; reniform, stalactitic, or massive; brittle; fracture flat conchoidal or earthy; translucent on edges to opaque; lustre vitreous, resinous, or dull; yellow, reddish, or blackish-brown; streak pale yellow; H. 2-3; G. 2·3-2·4.

B., etc. In matrass gives off H_2O and yields a white sublimate, often crystalline; on C melts readily to a dark magnetic globule, giving off copious white fumes with an alliaceous odour, and depositing a white coating on the cool part of the charcoal support; soluble in warm HCl or HNO_3.

Comp. Hydrated arseniate of iron, of very variable and uncertain composition.

Loc. Dolcoath, formerly; specimens were found in the year 1866, by Dr. C. Le Neve Foster, which were at first soft and plastic, but soon became harder, and fell to pieces; these are of a greyish-yellow colour. Found also in France, Germany, and many other localities.

Obs. It is probably a product of the decomposition of mispickel, with which some parts of Dolcoath abound.

Plastic. Capable of being moulded like clay.

Plumbago. See Graphite.

PLUMBIC OCHRE.

[Earthy Lead Ore.] Amorphous; massive; compact or earthy; opaque; dull; yellow, brownish, or bluish-brown; streak the same; H. 0-2; G. 8·0.

B., etc. In matrass unchanged; on C easily reduced to a malleable bead of lead; soluble in HNO_3 without effervescence.

Comp. Anhydrous oxide of lead.

Loc. "Earthy Lead Ore" was found about the year 1820 in Huel Mexico, Perranzabuloe; it was "amorphous, or in minute six-sided prisms (Plattnerite?) in cavities in ferruginous quartz;" the colour was straw-yellow or greenish-yellow. A specimen analysed by Mr. Michell yielded 20·2 per cent. of lead, 24·6 per cent. of iron, 2·4 per cent. of silver, 37·0 per cent. of silica, and 14·0 per cent. of oxygen, with a trace of chlorine.

Plush Copper. See Cuprite (Chalcotrichite).

Podar. An old Cornish term for pyritous dust or waste.

POLYBASITE.

Hexagonal (Nicol) or Rhombic (Dana); usually in short tabular prisms, the bases striated parallel to the alternate edges; also massive or disseminated; fracture uneven; opaque, or translucent in very thin pieces; lustre metallic; iron-black; thin plates cherry red by transmitted light; streak iron-black; H. 2-2·5; G. 6·0-6·25.

B., etc. In matrass decrepitates and fuses; in the open tube yields a sulphureous odour and a yellow or reddish sublimate; on C deposits a white coating of the oxides of Sb As or Zn, fusing, boiling, and yielding finally a white metallic alloy; with micro. gives indications of Cu; by cupellation a bead of silver; decomposed by HNO_3.

Comp. Anhydrous sulph-antimonide of silver and other bases. A Cornish specimen yielded to Joy the following results:—

Sulphur	15·87
Antimony	5·46
Arsenic	3·41
Silver	72·01
Copper	3·36
Iron	0·34
Total	100·45

Loc. "Cornwall" is given as a locality of Polybasite by Dana, but this *may* refer to a Cornwall *county* in the United States.

Polytelite. See Fahlerz.

Porcelain Clay. See Kaolin.

Porcelain Jasper. A highly indurated clay, much resembling true Jasper, but containing a large proportion of alumina.

PORCELLANITE.

[Porcelain Spar.] Rhombic (Brooke), prismatic angle 88°, or tetragonal (Dana), two cleavages forming right angles; also massive, compact, or columnar; brittle; fracture uneven; transparent to opaque; lustre vitreous, pearly, or greasy; white, grey, greenish, bluish, reddish; H. 5·5-6; G. 2·6-2·74.

B., etc. In matrass yields a *little* water; on C loses colour, and fuses at from 3 to 4 to a blebby glass; treated with Co turns blue; imperfectly decomposed by HCl.

Comp. Silicate of alumina, lime, and soda, with perhaps silica 50·6 per cent., alumina 28·1 per cent., lime 15·6 per cent., soda 5·7 per cent.

Loc. It is *said* to have been found near Redruth(?). It occurs in Norway, Sweden, and many foreign localities.

Obs. It is readily decomposed by exposure to air and moisture, and converted into friable porcelain earth, which frequently retains the form of the crystals.

Potash Mica. See Muscovite.

Potato Stone. See Geode.

Porphyry. Any rock which contains disseminated crystals distinct from the main mass. Thus there may be felspathic porphyry, claystone porphyry, granitic porphyry, &c. The Cornish elvans are usually porphyritic. The term was originally applied to a reddish or purplish syenitic porphyry found in Upper Egypt.

Porphyritic. See Porphyry.

Potstone. See Steatite.

PREHNITE.

Rhombic; in prisms (Fig. 96), striated, or closely aggregated laterally; cleavage basal, perfect; often botryoidal, reniform, or radiated; brittle; fracture uneven; translucent to transparent; lustre vitreous or pearly; white, or various shades of pale green or yellow; streak white; H. 6-7; G. 2·9-3; pyro-electric.

B., etc. In matrass gives off H_2O; on C fuses at about 3 to a blistered glass, with effervescence; scarcely acted upon by acids until after ignition, when HCl completely decomposes it, gelatinous silica being deposited.

Comp. Hydrated silicate of alumina and lime. With silica 43·0 per cent., alumina 24·4 per cent., lime 28·4 per cent., and water 4·2 per cent., which is pretty nearly what is yielded by Scottish specimens, the formula may be written $\dddot{A}l_2, 3Ca, 3\dot{S}i, H_2$ or $Si_3Ca^{\prime\prime}{}_3Al_2o^{vi} + OH_2$.

Loc. Roscommon cliff; a vein in the cliffs between Botallack and Huel Cock, with stilbite and mesotype; Botallack, Huel Cock, Levant, all in St. Just, formerly, in pale green groups of crystals; fine specimens are found in Scotland, Ireland, and many foreign localities.

Angles.

M M	100°	00′	i f	92°	00′
M o	128	33	M i	91	30
i j	177	20			

Prism. A solid figure, the base of which is any right-lined figure, while the sides are parallel. Figs. 2, 110, 111, 171, &c., are prisms. In mineralogy very short prisms are called *tables*, and the crystals are said to be *tabular*.

Prismatic Arseniate of Copper. See Olivenite.

Prismatic Arsenical Pyrites. See Mispickel.

Prismatic Bismuth Glance. See Bismuthinite.

Prismatic Cobalt Mica. See Erythrite.

Prismatic Copper Mica. See Chalcophyllite.

Prismatic Iron Pyrites. See Marcasite.

Prismatic System. See Crystallography: Rhombic System.

Prismatic Talc Mica. See Chlorite.

Prismatoidal Manganese Ore. See Manganite.

Protoxide of Uranium. See Pitchblende.

Pseudomorph. A substance having the *form* of one mineral and the *composition* of another. The chief kinds are those which are—

1. Pseudomorphs by *loss* of an ingredient, as when LIMONITE is found in the form of CHALYBITE. Such specimens have been found in several mines at St. Just, and other places in the two counties.

2. Pseudomorphs by *gain* of an ingredient, as when LIMONITE occurs in the form of HEMATITE. This is no uncommon condition of Limonite in many iron mines.

3. Pseudomorphs by *exchange* of ingredients, as when GALENA occurs in the form of PYROMORPHITE. Very fine examples of this change occurred at Huel Hope, in the year 1827.

In some specimens of Limonite after Pyrites; and in those of Felspar after Chlorite, observable in the granite of the north and western flanks of Carn Marth, the change often appears to *commence in the centre* and to proceed *outwards*. Sometimes this change proceeds until the *whole* of the original substance is replaced by one of totally different composition, as when Quartz, Calcedony, or Hornstone appear in the form of Fluor. Thus, Mr. J. Carne states that in some *cubic* Quartz found at Botallack is a crystal "in which the acuminated angles often seen in Fluor are well preserved." (Trans. Roy. Geol. Soc. Corn., vol. II.)

4. Pseudomorphs of *dimorphous* substances, as when CALCITE is found in the form of ARAGONITE.

5. Pseudomorphs by *incrustation*, formed as *moulds* on the surface of other minerals. These are often hollow, and sometimes contain fluids. In some specimens of Calcedony in hexagonal tabular crystals from Balleswidden, in one "the calcedony is merely a deposit on Calcite, which is everywhere visible; in the other, where the Calcite is seen at all, the line of it is but just perceptible, and in some parts is wholly gone, and the solid crystal of Calcedony remains."

6. Pseudomorphs by *infiltration*, formed as *casts* within the *moulds* mentioned in 5.

7. Pseudomorphs after *organic* forms, as when the substance of a *fossil* is replaced with mineral matter.

With these, the arborescent forms often met with in native copper and native silver must not be confounded. Such forms are in no way connected with organization, they are simple dendritic accretions, analagous to those of water on a window pane on a frosty night. Of this kind were, probably, some specimens of metallic copper, in the form of plants, from Treskerby, "The stem, and often the fibres of the leaves, were very perfect," so that "a good botanist might almost venture to give the names and descriptions of the plants." (J. Carne, Trans. Roy. Geol. Soc. Corn., vol. II.)

The following is as complete a list of Devonshire and Cornish Pseudomorphs as the author has been able to obtain. Where it was possible, he has indicated the class in which the specimen should be placed, but in some instances no particulars were obtainable:—

Group 1. Pseudomorphs by *loss* of ingredients—

	In the form of—		*Locality.*
1	*Limonite,*	*Chalybite,*	St. Just.
2	,,	,,	Perran Iron Lode
3	,,	*Garnet,*	Belstone Consols.

AUTHORITIES.—1, J. Carne (Trans. Roy. Geol. Soc. Corn., vol. vi.); 2, Prof. Smyth (*ibid.* vol. vii., p. 336); 3, J. Davis, Brit. Mus. (private information).

Group 2. Pseudomorphs by *gain* of ingredients—

	In the form of—		*Locality.*
1	*Limonite,*	*Hematite(?)*	Restormel. (?)

This locality is doubtful. The author has seen a well-marked specimen which is said to have come from there.

Group 3. Pseudomorphs by gradual *exchange* of ingredients—

	In the form of—		*Locality.*
1	*Limonite,*	*Pyrites,*	Levant.
2	,,	,,	Huel Owles.
3	,,	,,	Trecrobben Mine
4	*Oxide of Iron,*	*Felspar,*	Carnmarth.
5	*Hematite,*	*Calcite,*	Huel Ruby.
6	*Goethite,*	*Pyrites,*	Restormel.
7	*Wolfram,*	*Scheelite,*	Huel Maudlin.
8	*Galena,*	*Pyromorph.*	Huel Hope.
9	*Chalcopyrite,*	*Chalcocite,*	St. Ives Consols.
10	*Cerussite,*	*Galena,*	—
11	*Cassiterite,*	*Felspar,*	Huel Coates.
12	,,	,,	Carn Brecon.
13	,,	,,	Balleswidden.
14	,,	*Quartz,*	Huel Primrose.
15	*Chlorite,*	*Felspar,*	Carnmarth.
16	,,	,,	United Mines.
17	,,	,,	Pennance.
18	,,	,,	Carclaze.
19	*Calcedony,*	*Calcite,*	Balleswidden.
20	,,	*Datholite*	Haytor.
21	,,	,,	North Roskear.
22	*Kaolin,*	*Felspar,*	Balleswidden.
23	,,	,,	Tregoning hill.
24	,,	,,	Tremearne.
25	,,	,,	Vogue.
26	,,	,,	Carclaze.
27	,,	,,	St. Stephens.
28	*Schorl,*	*Felspar,*	St. Enoder.

AUTHORITIES.—1, 10, 14, 19, 20, J. Carne (Trans. R. G. S. C., vol. vi.); 2, 6, 13, 16, 28, R. Pearce (Rep. Roy. Inst. Corn., 1861, 1863, and private information); 5, Prof. Smyth (private information); 18, 26, Prof. Church (ditto); 7, Greg and Lettsom, (p. 354); 8, Michell (Man. Min., Truro, 1825, p. 9); 11, W. M. Tweedy (Rep. Roy. Inst. Corn., 1841, p. 39); 12, T. M. Hall (Min. Direct., p. 131); 3, 4, 9, 15, 17, 22, 23, 24, 25, 27, the author has himself seen, recently, many *in situ*.

Group 4. Pseudomorphs of *dimorphous substances.*

No example from Devon or Cornwall known to the author.

Group 5. Pseudomorphs by *incrustation*—

	In the form of—		*Locality.*
1	*Quartz,*	*Fluor,*	Huel Spearn.
2	,,	,,	Botallack.
3	,,	,,	Carnidjack.
4	,,	,,	Huel Alfred.
5	,,	,,	Huel Herland.
6	,,	,,	United Mines.
7	,,	,,	Consolidated Ms.
8	,,	,,	Trevascus.
9	,,	,,	North Roskear.
10	,,	,,	North Pool.
11	,,	,,	Dolcoath.
12	,,	,,	Huel Trelawny.
13	,,	,,	Huel Mary Ann.
14	,,	,,	Near Holmbush.
15	,,	*Chalybite*	Botallack.
16	,,	,,	Dolcoath.
17	,,	,,	Cook's Kitchen.
18	*Calcedony,*	*Fluor,*	Craft-an-verth.
19	,,	*Calcite,*	Balleswidden.
20	*Chalybite,*	*Selenite,*	Virtuous Lady.
21	,,	,,	Beeralstone.
22	,,	,,	Huel Friendship.
23	,,	*Fluor,*	Virtuous Lady.
24	,,	*Calcite,*	Beeralstone.
25	*Pyrites,*	,,	Herodsfoot.
26	*Quartz,*	*Chalybite,*	Consol. Mines.

AUTHORITIES.—1, 2, 4, 9, 18, 19, J. Carne (Trans. R. G. S. C., vol. vi.); 3, 15 (*ibid.* vol. ii.); 5, 6, 8, 10, 11, J. Garby (*ibid.* vol. vii., p. 73); 12, 13, 16, 17, R. Pearce (private information); 14, 25, Prof. Smyth (ditto); 20, 22, 23, 24, Greg and Lettsom (p. 260); 7, 26, R. W. Fox, F.R.S. (Rep. R. C. P. S., 1845, pp. 2, 7).

Group 6. Pseudomorphs by *infiltration.*

	In the form of—		*Locality.*
1	*Cassiterite,*	*Felspar,*	Huel Coates.
2	*Quartz,*	*Fluor,*	Consol. Mines.

Sometimes "the infused portion of Tinstone has not sufficed to fill the cavity left by the Felspar, in which case crystallization has taken place, and the Tinstone has assumed its ordinary form." (W. M. Tweedy, Rep. Roy. Inst. Corn. 1841, p. 39.)

AUTHORITY.—2, R. W. Fox, F.R.S. (Rep. R. C. P. S., 1845, p. 2).

Group 7. Pseudomorphs after *organic* forms—

	In the form of—		*Locality.*
1	*Calcedony.*	*Animal forms,*	Torquay.
2	,,	,,	Broadhembury.
3	,,	,,	Livermead Head.
4	,,		Paignton Harbr.
5	,,	*Shells,*	Haldon.
6	*Copper,*	*Plants,*(?)	Treskerby.
7	,,	,, (?)	Condurrow.

AUTHORITIES.—1, 2, 5, Prof. Church (Phil. Mag., 1864, and private information); 3, 4, W. Pengelley (Trans. R. G. S. C., vol. vii., p. 311); 6, 7, J. Carne (*ibid.* vol. ii.).

No particulars obtainable—

1	*Quartz,*	*Fluor,*	St. Agnes.
2	,,	,,	Gt. Crinnis.
3	,,	,,	South Caradon.
4	,,	,,	Carn Brea.
5	,,	,,	Balleswidden.
6	,,	,,	Spearn Moor.
7	,,	,,	Trehane.
8	,,	,,	Perranzabuloe.
9	*Quartz,*	*Fluor,*	Huel Sparnon.
10	,,	,,	Beerferris.
11	,,	,,	South Hooe.
12	,,	,,	Beeralstone.
13	,,	*Calcite,*	Gwennap.
14	,,	,,	St. Ives Consols.
15	,,	,,	Botallack.
16	,,	,,	Hay Tor.
17	,,	*Dolomite,*	Levant.
18	,,	,,	Huel Cock.
19	,,	*Felspar,*	Boscagel Downs.
20	*Calcedony,*	*Calcite,*	North Roskear.
21	,,	,,	Near Penzance.
22	,,	,,	Hay Tor.
23	,,	*Dolomite,*	North Roskear.
24	,,	,,	Levant.
25	,,	*Barytes,*	Herodsfoot.
26	,,	,,	Huel Mary.
27	*Limonite,*	*Calcite,*	S. Huel Basset.
28	,,	*Pyrites,*	Hennock.
29	,,	,,	Botallack.
30	,,	,,	S. Huel Basset.
31	,,	*Chalybite,*	Huel Owles.
32	,,	*Dolomite,*	,,
33	*Goethite,*	*Pyrites*	Restormel.
34	*Pyrites,*	*Chalybite,*	Restormel.
35	,,	*Calcite,*	Huel Mary.
36	,,	,,	Tavistock.
37	,,	*Albite,*	Consolidated Ms.
38	,,	*Barytes,*	Herodsfoot.
39	*Marcasite,*	*Calcite,*	Tamar Mine.
40	*Chalybite,*	*Calcite,*	Beeralstone.
41	,,	*Fluor,*	Fowey Consols.
42	,,	*Dolomite,*	Huel Owles.
43	*Hornstone,*	*Fluor,*	Beeralstone.
44	*Chlorite,*	*Magnetite,*	North Roskear.
45	,,	,,	Tresavean.
46	,,	*Albite,*	Consolidated Ms.
47	,,	*Axinite,*	St. Just. (?)
48	,,	,,	Dartmoor.
49	*Chalcopyrite,*	*Blende,*	Levant.
50	,,	,,	Huel Alfred.
51	,,	*Chalybite,*	Levant.
52	,,	*Fahlerz,*	,,
53	,,	,,	Crinnis.
54	,,	*Chalcocite,*	,,
55	,,	*Dolomite*(?)	Huel Tolgus.
56	,,	,,	St. Just.
57	*Malachite,*	*Cerussite,*	Near Redruth.
58	*Halite,*	?	Near Blackbrook
59	,,	?	Near Sidmouth.
60	*Pinite,*	*Iolite,*	Breage.
61	,,	,,	Lamorna.
62	,,	,,	St. Hilary.
63	,,	,,	Trewellard.
64	,,	,,	Mulvra Hill.
65	,,	,,	TolPedn Penwith
66	,,	,,	St. Michael's Mt.
67	,,	,,	Tregoning Hill.
68	,,	,,	Nr. Grampound.
69	,,	,,	Sennen.
70	*Mica,*	*Pinite,*	Nr. Land's End.
71	*Fluor*	*Felspar*	—

AUTHORITIES.—1, 6, 8, 11, 14, 17, 20, 24, 28, 29, 30, 40, 41, 49, 51, 52, 57, T. M. Hall, F.G.S. (Min. Direct., pp. 130, 131); 2, 3, 4, 5, 7, 9, 10, 12, 13, 16, 21, 22, 23, 25, 26, Greg and Lettsom p. 95, *et seq.*); 27, 30, 31 (*ibid.* p. 255); 32, 33, 38, 42, 53, 67, 70, 71, R. Pearce (Rep. R. I. C., and private inf.); 15, 18, 19, 43, 44, 54, 55, J. Carne (Trans. R. G. S. C., vol. ii.); 69, Prof. Smyth (private information); 68, De la Beche (Rep. on Cornwall, &c.); 58, 59, G. W. Ormerod (Rep. Dev. Assoc., vol. iii., p. 78); 45, 60, 67, the author has himself obtained.

Many of the pseudomorphs referred to are given on the authority of *several* mineralogists, although only one is mentioned in each case.

PSILOMELANE.

[Black Hematite. Compact Grey Oxide of Manganese.] Amorphous; botryoidal, stalactitic, or massive; surfaces often smooth; tough; fracture conchoidal, uneven, or even; lustre metallic, sub-metallic, or silky; dark steel-grey to iron-black; streak brownish-black and shining; H. 5-6; G. 4-4·4.

B., etc. In matrass yields a little water; on C infusible; with borax and soda gives Mn reactions; soluble in warm HCl, with evolution of Cl.

Comp. An impure peroxide of manganese of variable composition, often containing baryta and water. No analysis of a specimen from Cornwall or Devon is known to the author.

Loc. Restormel Royal Iron Mines, in splendid velvet-black stalactitic masses; Lifton, near Launceston; Creva Wood; St. Minver; Huel Bucketts; Pednandrea; Huel Tolgus; and other mines in Cornwall.

Black Down and Brent Tor, in fine botryoidal and stalactitic masses; East Down, Georgeham, West Down, and Viveham, near Barnstaple; near Bideford; Orleigh Court, Buckland Brewer; Blackdown; Upton Pyne, near Exeter; Chudleigh; Ashton, &c. It also occurs in Ireland, Germany, Norway, North America, &c.

Obs. It usually occurs associated with Manganite, Pyrolusite, and Wad. Some Cornish specimens occur in concentric layers, alternating with Pyrolusite or Wad. It may be easily distinguished from Pyrolusite and Wad by its hardness; from Hematite by the colour of its streak; and from Magnetite and Pitchblende by its reactions with soda and borax.

Purple Copper. See Erubescite.

Pyramid. A solid figure, whose base is any right-lined figure, and whose sides are all triangles. A pyramid in crystallography comprises two such figures, placed base to base, *i.e.*, a double pyramid. Fig. 1, the octahedron, is a pyramid with *square base*, the sides of which are *equal equilateral* triangles.

PYRARGYRITE.

[Dark Red Silver Ore. Antimonial Silver Blende. Rubin-Blende (in part).] Hexagonal; in prisms variously modified, and often macled (Figs. 213, 214); cleavage rhombohedral, perfect (R = 108° 42′); sometimes dendritic, micaceous, disseminated, or massive; brittle, or almost sectile; fracture conchoidal or uneven; translucent to opaque; lustre sub-metallic, adamantine, or resinous; dark red, lead-grey, or iron-black; streak dark red; H. 2-2·5; G. 5·7-5·9.

B., etc. In matrass decrepitates, and gives a reddish sublimate; on C fuses at 1, gives off a sulphureous odour, deposits a copious white incrustation of oxide of antimony; after long roasting yields a bead of Ag; insoluble in HCl; decomposed by HNO_3; the powder becomes black if treated with KHO.

Comp. Anhydrous sulphide of silver and antimony. With silver 59·9 per cent., antimony 22·5 per cent., and sulphur 17·6 per cent. its formula may be $SbAg_3S_3$ or $SbAg_3$.

Loc. Huel Herland, formerly, in small crystals, and granular; Mount Mine; North Dolcoath; Dolcoath; Huel Mexico; Huel Ludcott; Holmbush; Huel Brothers; Huel Duchy, Callington, in a cross-course, both crystallized and massive, with native silver, native copper, and black sulphide of silver. It has been found sparingly in Sark, also found in France, Germany, Chili, Peru, and other foreign localities.

Obs. It may be readily distinguished from Cuprite by its blowpipe reactions; from Chalcocite and Galena by its streak; from Tennantite by the crystalline form of the latter.

Angles.

e e′	= 137° 58′	a a′	= 120° 00′
e R	144 21		

PYRITES.

[Iron Pyrites. Mundic. Sulphide of Iron.] Cubic; in forms resembling Figs. 1, 2, 4, 8, 9, 16, 32, 43, 45, 46, 47, 48, 50, 52; the faces often striated or rough; macles like Fig. 58 not uncommon; often drusy on other minerals; also massive or compact; sometimes spheroidal, botryoidal, radiated, stalactitic, fibro-lamellar or cellular; brittle; tough; fracture conchoidal, uneven, or splintery; opaque; lustre metallic, splendant, sometimes shining or glimmering; brass-yellow; occasionally greenish-yellow or iridescent; streak black or greenish-black; H. 6-6·5; G. 4·8-5·1; gives off a sulphureous odour when broken, and is hard enough to give sparks when struck with steel.

Var. 1. Auriferous Pyrites is a variety containing a notable proportion of gold.

2. Argentiferous Pyrites contains silver.

3. Hepatic Pyrites is a variety of a brown colour, and partially converted into Limonite.

B., etc. In matrass gives a sublimate of S, which readily melts into brownish-yellow drops; turns black; on C fuses at 1, burns with a blue flame, forms a dark brittle magnetic globule, with a crystalline surface when cool; with borax gives Fe reactions; scarcely acted upon by HCl, nor by HNO_3 until finely powdered, when it dissolves, forming a greenish-yellow solution.

Comp. Anhydrous per-sulphide of iron. Common as it is, but few or no analyses of Cornish or Devonshire specimens are on record, at least within the knowledge of the author. With sulphur = 54·25 per cent., and iron 45·75 per cent. the composition would be indicated by FeS_2.

Loc. Fine specimens have occurred from time to time at Botallack, Levant, Huel Spearn, and other St. Just mines; at Providence Mine and West Poldice; Huel Darlington; Mount Mine; Great Work, Godolphin, Huel Vor, and other mines in Breage (Figs. 2, 43, and 45, imbedded in chlorite, as well as other forms); Huel Herland, Gwinear; Huel Trannack; Huel Prospidnick, Sithney, in chlorite (Fig. 45); Cadgwith; Bellurian Cove, near Mullion, in a conglomerate, with native copper; Dolcoath, Carn Brea, Tincroft, East Pool, and most of the mines in Camborne and Illogan; Huel Unity, Ting Tang, Tresavean, and most of the mines in Gwennap; Huel Buller, Copper Hill, Pednandrea, and other Redruth mines; Creegbrawse; Huel Jane; Huel Falmouth; Nangiles; Retallack, Huel Golden, and other mines in Perranzabuloe; St. Agnes, magnetic, in cubes? of one inch, formerly (J. Garby, Trans. R. G. S. C., vol. vii., p. 82); Fowey Consols; Polgooth; Lanescot; Crinnis; Pembroke; Great Dowgas; Huel Maudlin; Herodsfoot; Huel Maria, in chlorite, deeply striated and iridescent.

Huel Friendship; Combemartin; Virtuous Lady, Bedford United, and other mines near Tavistock; Huel Robert, Sampford Spiney; Parracombe, in trap ash; Bishop's Tawton, Venn, Bickington, Viveham, and other places near Barnstaple, disseminated in the rocks; near Tiverton, in a quarry, in the interior of fossil shells; in the cliffs to the west of Axmouth, &c.

Stalactitic Pyrites occurs at East Pool and other localities.

Pyrites occurs pseudomorphous after calcite near Tavistock and other places; after fluor at Beeralstone, &c.; after albite at the Consolidated Mines, Gwennap, &c. See Pseudomorphs.

Obs. It is, in small quantities at least, almost universally distributed in metalliferous districts; few mines being absolutely without specimens. It may be readily distinguished from Gold by its hardness and brittleness; from Chalcopyrite by its hardness; from Marcasite it can only be distinguished with certainty by its crystalline form (Marcasite is, however, said to be more often radiated and fibrous, of a paler colour, often greenish, and much more liable to decomposition. It is largely used in the manufacture of sulphuric acid.

Angles.

o o =	109°	28′	e o =	140°	16′
a a	90	00	o v	157	47
o a	125	16	k o	160	32
a e	153	26	k k	148	50

The cube Fig. 2, octahedron Fig. 1, pentagonal dodecahedron Fig. 43, and Figs. 45, 46, 47, 48, 52 are the most common forms.

Pyritous Copper. An old name for Chalcopyrite.

Pyro-electric. Minerals which become electric by heating are so called. *Ex.* Tourmaline.

PYROLUSITE.

Black Oxide of Manganese. Anhydrous Binoxide of Manganese.] Rhombic; rarely crystallized distinctly; sometimes in crystals, like Figs. 136, 137; a Cornish specimen in the author's collection like Fig. 242; botryoidal, reniform, columnar, fibrous; massive, compact, granular, or earthy; brittle; fracture uneven; opaque; lustre metallic, submetallic, or silky; steel-grey, to iron or bluish-black; soft enough to soil the fingers when handled; H. 2-2·5; G. 4·7-5·0.

B., etc. In matrass unchanged, or gives off a *little* water; on C unchanged, or turns reddish; with soda and borax gives Mn reactions; soluble in HCl, with evolution of Cl.

Comp. Anhydrous manganic dioxide, with often small quantities of oxides of iron and baryta. When pure the composition will be manganese 63·3 per cent., oxygen 36·7, when the formula may be written $\dot{M}n_2$ or Mn_2O_3.

Loc. Tregony, Veryan; Restormel; Indian Queens, Creva Wood, Callington; Lifton and Trebartha, near Launceston;

Tresweeta, St. Stephens; near Calstock; and most of the manganese mines of East Cornwall.

Tavistock; Brent Tor (on Psilomelane); Upton Pyne, near Exeter; Georgeham and Viveham, near Barnstaple; Newton St. Cyres, Doddiscombleigh, and Ashton, near Chudleigh; and other Devon localities. ("Manganese" occurs near Buckfastleigh; Dean Church, south of Buckfastleigh; Lew Trenchard; Leigh Down; East Cot Beacon; Higher Chillaton; Narracol; Wick; Bowdon Down, south of Marystow, &c. See Ordnance Map.) Foreign localities very numerous.

Obs. It may be distinguished from Psilomelane and Manganite, with which it is usually accompanied, by its inferior *hardness;* from Antimonite and Jamesonite by its infusibility. It is largely used in the preparation of chloride of lime, for bleaching purposes; and for glass making.

Angles.

M M′ =	93°	40′	M O =	90°	00′
O d	128	45			

PYROMORPHITE.

[Brown Lead Ore. Green Lead Ore. Phosphate of Lead.] Hexagonal; in horizontally striated prisms, with the terminal edges often replaced, and the basal plane concave or rough (Figs. 188, 190, 192); also globular, reniform, botryoidal, or massive; brittle; fracture imperfect conchoidal; semitransparent to translucent on thin edges only; lustre resinous to adamantine; splendant to glimmering; various shades of green, grey, yellow, or brown; streak white, or pale yellowish, or greenish-brown; H. 3·5-4; G. 6·5-7·1.

B., etc. In matrass darkens; on C fuses at 1 to a bead which crystallizes suddenly on cooling, tinging the flame green on the edges; with soda yields a bead of Pb; sometimes gives off an alliaceous odour; when fused with oxide of copper yields a beautiful blue flame; insoluble in HCl; soluble in HNO_3.

Comp. Anhydrous chlorophosphate of lead. No analysis of a specimen from Devon or Cornwall is known to the author, but foreign specimens yield nearly 15·6 per cent. of phosphoric anhydride, 81·8 per cent. of oxide of lead, and 2·6 per cent. of chlorine. With these proportions the formula will be

$$\dot{\dot{\dot{P}}}b_3P_2 + PbCl_2 \text{ or } P_3O_3Pbo_4{}''PbClO.$$

similar to that of apatite, viz., $9Pb3P_2 +$

Loc. Very fine crystals, formerly, at Huel Alfred, and Huel Hope (mostly changed into galena); more recently at Huel Rose and Huel Penrose, Sithney; Penberthy Croft; Huel Bell; Huel Kea; Huel Falmouth; Huel Golden; Beeralstone, in grey masses, with mimetite, &c. It is found also in Derbyshire, Yorkshire, Cumberland, Wales, and many foreign localities.

Obs. The phosphoric anhydride is very frequently replaced in part by arsenic anhydride, especially in the yellow, grey, or brown specimens. Sometimes the lead is largely replaced by lime, when the sp. gr. is much below that given above.

Angles.

a a′ =	120°	00′	O x =	139°	38′
O a	90	00	x x′	142	12
x a	130	22	b a	150	00

Pyrophosphoric. A term applied to substances which "phosphoresce" on heating. *Ex.* Fluor, especially Chlorophane.

PYROXENE.

[Augite. Diallage, in part. Malacolite. Sahlite; &c.] Oblique; when crystallized usually in modified prisms (augite like Figs. 160, 161); cleavage parallel to M, tolerably perfect; the faces a b often striated longitudinally; macles not uncommon; brittle; fracture conchoidal or uneven; sometimes transparent, but more usually translucent or opaque; lustre vitreous, sometimes colourless, but more usually grey, green, dark brown, or black; streak white to grey; H. 4-6; G. 3·2-3·3.

Var. 1. Augite. Often dull, dark green, or nearly black, and opaque; usually fusible at about 2. Usually contains notable quantities of alumina.

2. Diopside. Green and transparent; very brilliant.

3. Sahlite. Often greyish.

4. Diallage. Diallage—Metalloide, Schiller-Spar, Bastite, is perhaps the same; lamellar, greyish or brownish; curved cleavages; sometimes classed with Hypersthene. H. = 4. See also Schiller-Spar.

5. Bronzite. Very similar, but darker and less fusible. See also Hypersthene.

6. Saussurite (which see) is, perhaps, a variety.

7. Smaragdite is grass-green; H. 5; G. 3·3·1.

Many other varieties have been distinguished.

B., etc. In matrass scarcely changed; on C most varieties fuse quietly at about 2 (some intumesce somewhat) to a glassy bead; with borax and micro. give Fe reactions; scarcely soluble, however, in micro.; the light varieties become pinkish,

if treated with Co; scarcely affected by acids, except when in fine powder; a long digestion sometimes partially decomposes it.

Comp. Anhydrous silicate of Mg, Ca, and other bases. No analysis of a British specimen is known to the author, but foreign specimens sometimes yield about 55·6 per cent. of silica, 25·7 of lime, and 18·6 of magnesia. With these proportions the formula might be written

. . . . .

$CaSiMgSi$ or $CaSiO_3+MgSiO_3$ or Si_2O_2 Cao"Mgo".

Loc. a. Augite. Rocks north of Botallack, and Huel Cock.

b. Bronzite. Coverack Cove, of a dark brown colour, in serpentine.

c. Diallage. In "Diallage Rock" at Coverack Cove, Crousa Downs, Gwinter, and many other parts of the St. Keverne district; the Manacles; &c.

d. Smaragdite is said to have occurred at Coverack (J. Garby, Trans. Roy. Geol. Soc. Corn., vol. vii., p. 76).

Obs. Pyroxene in its various forms is a common mineral in crystalline limestones and dolomites, serpentines, volcanic rocks, &c.; it occours also, but less abundantly, with granitic rocks and metamorphic schists. The pyroxene of limestones is mostly white, light green, or greyish; that of most other metamorphosed rocks although *sometimes* colourless, is usually green of various shades, from pale green to greenish-black: that of serpentine sometimes occurs in fine crystals, often of the foliated green kind called "Diallage;" that of eruptive rocks is the black, or greenish-black "Augite."

"Lime is a prominent ingredient in all the varieties of Pyroxene, while it is wanting, or nearly so, in some (most?) of those of Hornblende." "In Pyroxene, columnar and fine fibrous forms are uncommon; in Hornblende, exceedingly common." (Dana, System of Min., 1868.)

It really seems as if the many varieties of so-called Pyroxene, Amphibole, Hypersthene, &c., are still too little known to allow of a rational classification. They should, perhaps, form one great group, only divisible into *sub-species.*

Descloizeaux separates *Bronzite* "du Cap Lizard, Cornouailles," and *Hypersthene* from *Diallage* and *Pyroxene* on account of their *crystallographic* and *optical* characters.

Angles.

M M' =	87°	06′	a b =	90°	00′
M a	133	55	s b	119	44
M b	136	27	s s	120	31

PYRRHOTITE.

[Pyrrhotine. Magnetic Pyrites.] Hexagonal, in prisms, with perfect basal cleavage, but very rarely crystallized; usually massive; lamellar, granular, compact or disseminated; brittle; fracture uneven; opaque; lustre metallic; bronze yellow, with often a reddish or brownish tarnish; streak greenish or greyish-black; H. 3·5-4·5; G. 4·4-4·7; slightly magnetic.

B., etc. In matrass yields a yellow sublimate of sulphur; on C fuses at 1 to a grey magnetic globule; with soda gives Fe reactions; soluble in warm HCl, with evolution of H_2S.

Comp. Anhydrous proto-sulphide of iron. The following analysis of a Cornish specimen is by Hatchett:—

Iron	63·5
Sulphur	36·5
Total	100·0

This agrees almost exactly with the formula FeS, but some specimens seem to have an excess of sulphur.

Loc. Botallack; Levant; Huel Jane, Huel Kind, St. Agnes; "Magnetic pyrites has been found at St. Agnes, in *cubic* (?) crystals, upwards of an inch in diameter, and also massive, of a lamellar structure, in this and other localities of the mining districts" (J. Garby); Huel Maudlin, cleavable and massive; Huel Kit church, near Bodmin (massive).

Beeralstone; Meldon Quarry, near Okehampton. Found also in Wales, Scotland, Ireland, and many foreign localities.

Obs. It may be distinguished from Pyrites by its inferior hardness, from Chalcopyrite by its colour and blowpipe reactions, from Pentlandite by its magnetism and by the absence of nickel.

Quartz. A family name which conveniently includes the following four species, or sub-species, viz.:—

1 QUARTZ, or Hyaline Quartz,
2 JASPER,
3 CALCEDONY,
4 OPAL.

These are each described under their respective heads.

Probably a division of the whole family into *Crystalloid* Quartz, including Quartz proper and Jasper; and *Colloid* Quartz, including Calcedony and Opal, would be the most natural.

Jasper seems to be nothing more than ordinary massive quartz rendered opaque by the presence of foreign matter in very variable proportions. This would hardly seem to be a sufficient reason for separating it, since some well-defined Quartz

crystals (ferruginous) have been analysed and found to contain as much as 5·0 per cent. of peroxide of iron.

Calcedony is evidently distinct from Quartz by its essentially non-crystalline (colloid) character, but as the purest varieties have usually a small proportion of water, are somewhat softer than Hyaline Quartz, are often somewhat lighter, and always partially soluble in solution of caustic potash, it does not seem clear that it should be separated from Opal. Flint would probably form a passage to Semi-Opal, and Carnelian to Noble Opal.

QUARTZ.

[Rock Crystal, &c.] Hexagonal, in forms like Figs. 203 to 211, 243, &c.; usually in prisms, horizontally striated, sometimes doubly terminated; more usually singly terminated, with the summit planes very unequally developed; no distinct cleavage, but sometimes in laterally adherent groups, producing a pseudo-cleavage; parallel or divergent; not unfrequently macled; also massive; compact, granular, columnar, fibrous, cellular, &c.; brittle; fracture conchoidal, uneven, or "rippled" in amethyst; transparent to translucent (Jasper is opaque); lustre vitreous, sub-adamantine, or resinous on fracture; splendant to glimmering; colourless, or yellow, red, green, brown, purple, black, &c.; streak white; H. 7·0; G. 2·5-2·8, the purest varieties 2·65; frictio-phosphoric.

Var. 1. *Rock Crystal* is the colourless crystallized (typical) variety. Cornish, Bristol, Irish, and other so-called diamonds are rock crystal. The Cornish Diamonds are often obscured by an opaque ferruginous layer when first obtained.

2. *Amethyst* is a variety with a peculiar "rippled" fracture, which possesses some remarkable optical properties. It is usually of a more or less deep violet or purple tint; in some instances this has been proved to be due to a minute trace of oxide of manganese. "Heintz, however, on analysing a very deep purple specimen from the Brazils, obtained in addition to silica, 0·0187 protoxide of iron, 0.6236 lime, 0·0133 magnesia, and 0·0418 soda, whence he infers that the colour is due to a compound of iron and soda." (Bristow's Gloss. Min. p. 13.)

3. *Citrine* or *False Topaz* is a variety tinted of a clear yellow colour with oxide of iron.

4. *Ferruginous Quartz* is the same, but duller, and with less lustre.

5. *Cairngorm* or *Smoky Quartz* is a clear transparent variety having a rich smoky-brown tint.

6. *Morion* is the same, but so deeply tinted as to appear almost black.

7. *Rose Quartz*, as the name implies, is of a rosy tint, but usually very pale, and often full of cracks.

8. *Milk Quartz* is bluish-white and nearly opaque.

9. *Greasy Quartz* is compact and massive, and so-called because of the "greasy" lustre.

10. *Sugary Quartz* is granular, like loaf-sugar.

11. *Cellular Quartz* or *Floatstone* consists of a multitude of small cells, filled with air, and surrounded with very thin films of quartz. It is so light as to float on water. Specimens from Pednandrea and other mines would seem to indicate that it is a pseudomorphous deposit on Fluor Spar, which has now disappeared.

12. *Fibrous Quartz* or *Cross-course Spar* is made up of a multitude of imperfect prisms laid side by side; the free terminations often present crystalline planes.

13. *Prase* is a dark leek-green variety, which occurs massive only. The colour is said to be caused by an admixture of Amphibole.

14. *Babel Quartz* is a name given to peculiarly formed crystals, like Fig. 209.

15. *Hacked Quartz* is a crystalline variety of Quartz, with markings on its sides as if "chopped" or "hacked," arising from former partially imbedded crystals.

16. *Stalactitic Quartz* "consists of straight stalactites, several inches in length, composed of an aggregation of crystals diverging from a centre (of calcedony?), the pyramid of the crystal appearing on the surface." (Phillips's Mineralogy, 1823, p. 7.)

17. *Haytorite* is rather Calcedony than Quartz. It occurs in pale brownish crystals, having the form of Datholite, at Haytor and North Roskear.

B., etc. In matrass no change; on C alone, infusible; with soda or borax fuses with much effervescence to a clear glass; with micro. retains its form; insoluble in HCl, HNO_3, or H_2SO_4; soluble in HF.

Comp. Anhydrous silica. With silicon 48·94 per cent. and oxygen 51·96 per cent., the formula will be SiO_2. It often contains *small* quantities of various metallic oxides. Some very rare instances of crystals of *ferruginous* quartz from Botallack have yielded as much as 5 per cent. of peroxide of iron.

Loc. a. *Rock Crystal.* CORNWALL.—Fine specimens have occurred at Botallack, Boscawen Cliffs, Balleswidden, Spearn Moor, Trewellard, Huel Diamond, and other localities in St. Just; at St. Michael's Mount; Huel Alfred, Phillack (rhombohedrons); at Herland and Trevascus, in Gwinear; at the Lizard, in serpentine; at Swanpool and Mainporth, near Falmouth (the primary rhombohedron, more or less perfect, and other forms, in elvan); at Dolcoath (Fig. 243 is a curious example from here); North Roskear, and other mines in Camborne; at East Huel Crofty, East Pool, and the Carn Brea mines in Illogan (Fig. 208, 211, &c.); Huel Buller, Huel Sparnon, and other mines in Redruth; the Consolidated and other mines in Gwennap (primary rhombohedrons and other forms); at Perranzabuloe (double pyramid without prism); St. Ewe, in slate; near Caerhayes (primary rhombohedron); at Penlane and Trelowth, in St. Columb (with pinite in elvan); East Crinnis, St. Blazey; Restormel, Lostwithiel; Huel Mary Ann, Menheniot; at the Delabole Slate Quarries, St. Teath; Tintagel. "They occur in nests in the slate-stone, imbedded in a yellowish-white clay, like mud, and sometimes as black as wet soot. The whitish-yellow fluid is decomposed adularia, many perfect crystals of which are found adhering to the quartz. The black matter is decomposed slate stone." (Man. of Min., Truro, 1825, p. 187.)

DEVON.—Roborough Downs, Buckland Monachorum (in fine double pyramids); Huel Betsy, near Tavistock; near Okehampton; Gidleigh, near Moretonhampstead; North Bovey; Combemartin, near Ilfracombe; Lundy Island, &c.

Foreign localities are too numerous to mention.

b. *Amethyst.* Botallack, Huel Bellon, Huel Cock, Bosavern, Levant, Nangisel Cove, Roscommon Cliff, and other St. Just localities; Huel Uny; Copper Hill; Pednandrea; Huel Tolgus; East Pool, with pale yellow chalybite; Great Hewas United, St. Mewan; Polgooth; St. Cleer; St. Ewe, &c., finely crystallized in prisms; Copper Hill, near Okehampton.

c. *Citrine.* Botallack; St. Michael's Mount; Carn Brea; Restormel.

d. *Ferruginous Quartz.* Botallack; Marazion; Carn Brea; Dolcoath; Restormel; St. Agnes; North Bovey, in large opaque crystals (like Fig. 210).

e. *Cairngorm.* Trewellard; North Roskear; Huel Buller; St. Cleer; St. Ewe.

f. *Morion.* Little Bounds, formerly, in brilliant double pyramids; Huel Ruby; Fowey.

g. *Rose Quartz.* St. Michael's Mount, in small crystals, with cassiterite; Huel Bucketts, massive and crystallized, and usually full of cracks.

h. *Milky Quartz.* North Roskear, massive, bluish; Pednandrea; United Mines, Gwennap; Great Huel Vor, Breage.

i. *Sugary Quartz.* St. Agnes; Mount Hawke; &c.

j. *Floatstone.* Huel Alfred; Cardrew Downs; Pednandrea; Relistian, &c.

k. *Fibrous Quartz.* Huel Virgin; Tolcarne; Cardrew Downs; St. Agnes; Relistian.

l. *Prase.* Huel Bellon; North Roskear, dark green and massive.

m. *Hacked Quartz.* Huel Trelawny; East Pool.

n. *Babel Quartz.* Tamar Mines.

o. *Stalactitic Quartz.* Botallack, and Huel Alfred, formerly; more recently at Pednandrea.

Ordinary massive Quartz is common in almost every mine and quarry, while a large proportion of granite consists of imperfect crystals of the same mineral.

Many specimens of Quartz from different localities contain enclosed crystals of schorl and other minerals. A few localities are appended:—

	Enclosing—	*Locality.*
Rock Crystal,	*Cassiterite,*	Huel Diamond.
,,	*Pyrites,*	,,
,,	*Chalcopyrite,*	,,
,,	*Chlorite,*	Dolcoath.
,,	*Hematite,*	Botallack.
,,	,,	Dolcoath.
,,	,,	East Pool.
,,	,,	Restormel.
Amethyst,	*Schorl,*	Roscommon Cliff.
,,	*Chlorite,*	Botallack.
Quartz,	*Liquids,*	Utd. Mines (octa).
,,	,,	Virtu. Lady (cubes)
,,	,,	Beeralstone (cubes)

For the many Quartz pseudomorphs see list of Pseudomorphs.

Obs. The Quartz from copper lodes is said to be rarely transparent. Long narrow prisms are said to be most common in *tin* lodes, and almost unknown in lodes containing *lead.* There is often a peculiar brilliancy observable about the quartz from lead lodes, which may be well observed in specimens from West Chiverton, and Huel Rose and Huel Penrose, Sithney. Quartz may be distinguished from other minerals somewhat resembling it by its degree of hardness, crystalline form, brittleness, want of cleavage, and other characters.

Angles.

R R =	94°	15′	b s =	142°	00′
R z	133	44	b x	167	59
R b	158	31	b z	141	47
b b	120	00	b ζ	172	31

R.

Radiated Pyrites. See Marcasite and Pyrites.

Radiated Zeolite. See Stilbite.

Red Chalk. See Hematite.

Red Cobalt Ochre. See Erythrite.

Red Copper Ore. See Cuprite.

Red Hematite. Red Iron Ore. Red Iron Ochre. Red Iron Stone. } See Hematite.

Red Oxide of Copper. See Cuprite.

Red Oxide of Iron. Reddle. } See Hematite.

Red Silver Ore. See Pyrargyrite.

Reduced. The conversion of a higher oxide, sulphide, &c., into a compound containing a lower proportion of oxygen, sulphur, &c., or into the metallic state, either by driving off the metalloid, or, more usually, by adding some "flux" or "reducing agent" to combine therewith. The blowpipe is often used for reductions on a small scale. See "Blowpipe," par. 5, p. 18.

Reduction. The operation of reducing, as when copper is obtained from copper ore, or tin from tin ore, &c.

Redruthite. See Chalcocite.

Reflected Light. Light *reflected* from any surface. When objects are looked "at," and not looked "through," they are seen by *reflected* light. When looked "through" they are seen by *transmitted* light.

Reniform. Kidney-shaped. Having small irregular rounded prominences like the surface of a bullock's kidney.

Replaced. See Modified.

Reticulate. Netted. Some specimens of native copper occur in interlaced fibres, and are so-called.

RETINITE.

[Retinasphaltum.] Amorphous, in rounded or irregular lumps; brittle; fracture imperfect conchoidal, earthy, or uneven; translucent to opaque; lustre resinous, glistening, or dull; yellow, yellowish-brown, greenish, reddish, or dark greyish-brown; streak lighter than colour; H. 1-2·5; G. 1-1·2.

B., etc. In matrass melts to a clear fluid at a low temperature; on C burns with a bright flame, and fragrant or aromatic odour; insoluble in acids; partly soluble in alcohol, leaving an unctuous residue; more readily soluble in ether.

Comp.

Carbon	76·86
Hydrogen	8·75
Oxygen	14·39
Total	100·00

(J. F. W. Johnston, Phil. Mag. III., XII., p. 560, 1838.)

The composition is a little indicated in another way as follows:—

	a.		b.
Resin, Sol. in alco.	55·0	...	59·32
Bitumen	41·0	...	27·45
Earthy matter	3·0	...	13·23
Total	99·0	...	100·00

a. is by Hatchett, b. by Johnston.

Loc. Bovey Tracey, in irregular nodules, in Lignite. Found also in Hanover, with peat, and in the United States.

RHODONITE.

[Siliciferous Oxide of Manganese.] Oblique; isomorphous with augite (Brooke), anorthic (Greg and Lettsom); crystals very rare; cleavage perfect clinodiagonal; usually massive; compact or granular; brittle; fracture flat conchoidal or uneven; translucent to opaque; lustre vitreous to pearly; rose-red to reddish-brown, or greenish; sometimes a dark tarnish from exposure to light; streak very light or white; H. 5-6; G. 3·4-3·7.

B., etc. In matrass slightly darkens; on C turns brown, and fuses to a dark globule with a strong heat; with borax gives Mn reactions; soluble except the silica in strong HCl if finely powdered.

Comp. Anhydrous silicate of manganese. With silica 46·0 per cent. and protoxide of manganese 54·0 per cent. the formula may be written $\dot{M}n\dot{S}i$ or $MnSiO_3$ or SiOMno".

Loc. At a manganese quarry, 1½ mile south-east of Callington; Creva Wood, near Callington; Trebartha? Indian Queens? Veryan? Blackdown, with manganite and psilomelane; Upton Pyne. Found also in Germany, Italy, Sweden, Siberia, and many other foreign localities.

Rhomb. A four-sided plane figure, whose sides are equal straight lines, but whose angles are not right angles.

Rhomb Spar. See Dolomite.

Rhombic Dodecahedron. A solid twelve-sided figure, belonging to the *cubic system*, in which each face is a rhomb (Fig. 3).

Rhombohedral Iron Ore. See Hematite.

Rhombohedral Iron Pyrites. See Pyrrhotite.

Rhombohedron. A solid figure, bounded by six equal rhombs. See Fig. 197.

Rhomboid. A plane four-sided figure, the opposite sides of which only are equal, and whose angles are not right angles.

Rock Cork, Paper, Wood, &c. See Amphibole.
Rock Crystal. See Quartz.
Rock Marrow. See Lithomarge.
Ruby Silver. See Pyrargyrite.

RUTILE.

Pyramidal; in small prisms or pyramids, often macled, striated, or uneven, and having a general resemblance to crystals of cassiterite (Figs. 61 to 71); two tolerably perfect cleavages; often imbedded or massive; brittle; fracture conchoidal or uneven; translucent to opaque; lustre adamantine or sub-metallic; splendant to glimmering; brownish, reddish, yellowish, or blackish; streak light brown; H. 6·0-6·5; G. 4·2-4·8.

B., etc. Like Anatase.

Comp. Titanic anhydride, like Anatase and Brookite.

Loc. It is said to have been found in the slate quarries of Delabole, in hair brown threads, imbedded in quartz crystals, or in four or six-sided prisms, longitudinally striated; and at Tintagel cliffs, in brilliant prisms, imbedded in transparent quartz.

S.

Saponite. See Steatite.

SAUSSURITE.

Anorthic? sometimes cleavable in two directions, making angles of 124°; tough; fracture splintery or uneven; translucent to opaque; lustre glimmering; greyish-white, green, red, brown; streak white; H. 5-6; G. 2·7-3·4.

B., etc. In matrass unchanged; on C fuses at 4 to a greyish enamel; insoluble in acids except HF.

Comp. Anhydrous silicate of alumina, lime, and magnesia. The following analysis of a specimen from Coverack, is by Dr. Thomson:—

Silica	82·168
Alumina	5·072
Oxide of iron and manganese	2·880
Lime	5·520
Magnesia	4·520
Potash	trace
Total	100·160

Loc. Coverack and Kynance Coves, and Gwinter, in the Lizard district, with diallage rock. It is, perhaps, the so-called *Jade* of that neighbourhood.

Scalenohedron. A solid figure, bounded by twelve equal scalene triangles, as in Fig. 217. It is a common form of calcite in some districts.

SCAPOLITE.

[Meionite. Wernerite.] Pyramidal, with perfect prismatic cleavage; often massive and compact; brittle; fracture conchoidal; translucent to opaque; lustre vitreous, resinous, or pearly on cleavage; colourless, white, grey, greenish, reddish, brownish; streak white; H. 5·0-5·5; G. 2·6-2·8.

B., etc. In matrass unchanged; on C melts at 3 to a transparent glass; treated with Co turns blue; soluble with effervescence in borax or micro.; decomposed, in powder, by HCl.

Comp. Anhydrous silicate of alumina and lime. No analysis of a British specimen is known to the author, but foreign specimens contain from 37 to 54 per cent. of silica, 25 to 35 per cent. of alumina, and 9 to 24 per cent. of lime.

Loc. A little south of the village of Chagford, in a narrow vein of granite, with felspar, schorl, quartz crystals, and calcedony. It was found in the year 1868, by Mr. G. W. Ormerod, F.G.S., and occurred in a mass as large as the palm of the hand (Rep. Dev. Assoc., vol. III., p. 80, 1869).

SCHEELITE.

[Tungstate of Lime.] Pyramidal; in attached or imbedded four-sided prisms, usually more or less modified (Figs. 86, 87, 88); with some faces striated, rough, or curved; sometimes reniform, columnar, or massive; brittle; fracture conchoidal or uneven; translucent to opaque; lustre vitreous, resinous, or adamantine; colourless, greyish, yellowish, reddish, brown, or green; streak white or slightly tinged; H. 4-4·5; G. 5·9-6·2.

B., etc. In matrass no change, or decrepitates only; on C decrepitates and becomes opaque; fuses at 4, or infusible; soluble in HCl or HNO_3, except yellow tungstic anhydride, which separates; soluble, except the lime, in KHO; yellow tungstic anhydride is precipitated on addition of HCl or HNO_3.

Comp. Anhydrous tungstate of lime. A specimen from Pengelly Croft yielded to Klaproth the following results, viz.:—

Lime	18·70
Tungstic anhydride	75·25
Silica	1·50
Peroxide of iron	1·25
Peroxide of manganese	0·75
Total	97·45

With tungstic anhydride 81·0 per cent.

and lime 19 per cent. the formula may be written $\dot{Ca}\dddot{W}$ or $CaWO_4$ or WO_3Cao''.

Loc. Pengelley Croft, Breage, formerly, in a tin lode; Huel Maudlin; Huel Friendship, in fine octahedrons of a rich yellow colour, imbedded in chlorite, and occasionally associated with wolfram—the crystals formerly met with at this locality were sometimes 1½ inch long. It is found also in many foreign localities.

Obs. Like other ores of tungsten, Scheelite is characterised by a high sp. gr. It was in this mineral that tungstic anhydride (acid) and tungsten were first discovered by Scheele.

Angles.

P P	= 100°	40′	e e	= 108°	12′
P P′	129	02	e e′	112	02
P e	140	10	e y	171	30
P x	151	34			

Scheel Ore. See Wolfram.

SCHILLER SPAR.

[Diallage-metalloide. Bastite.] Oblique, or anorthic; one very perfect cleavage; brittle; fracture uneven or splintery; translucent to opaque; lustre pearly, sub-adamantine, or sub-metallic; greenish, yellowish, or brownish; streak nearly white; H. 3·5-4; G. 2·6-2·8.

B., etc. In matrass yields water, which has often an alkaline reaction; on C becomes brown and often magnetic; fusible at about 4; with borax gives reactions for iron or chromium; decomposed by H_2SO_4; less completely by HCl.

Comp. Hydrated silicate of magnesia and other bases. No analysis of a British specimen is known to the author, but foreign specimens contain about 43·0 per cent. of silica, 26·0 per cent. of magnesia, 12·0 per cent. of iron, and 12·0 per cent. of water.

Loc. Coverack, Gwinter, Kildown near Cadgwith, Kennick Sands, and other parts of the Lizard district, imbedded in a serpentinous rock.

Obs. Its composition and peculiar properties, need special investigation. It should, perhaps, be regarded as a subspecies of Pyroxene. Perhaps several distinct minerals have been described under this name.

Schist. An imperfectly foliated rock, which splits up into thin irregular plates. The Cornish and Devonshire killas is Schist. Mica-Schist occurs in the neighbourhood of St. Ives and other places.

Schorl. See Tourmaline.

SCHROTTERITE.

Amorphous; compact; massive; brittle; translucent to nearly transparent; lustre resinous or greasy; white, more often greenish, yellowish, or spotted with brown; streak white; H. 3·3·5; G. 1·9-2·1.

B., etc. In matrass yields much water; on C becomes a white opaque infusible mass; with Co turns a fine blue colour; decomposed by HCl.

Comp. Hydrated silicate of alumina, like Allophane, but with less silica. Dana gives about 12 per cent. of silica for Schrotterite, and 20·0 per cent. for Allophane.

Loc. Cornwall (Dana). See remarks on Allophane, p. 3.

SCORODITE.

[Martial Arseniate of Copper.] Rhombic; in globular groups of small crystals, shewing faces of the prism and pyramid (Fig. 244); perfect cleavage parallel to M; often drusy on other minerals; rarely compact; brittle; fracture uneven; semi-transparent to translucent on edges only; lustre vitreous, resinous, or adamantine; streak white or nearly so; pale green, bluish, brownish; dichroic; H. 3·5-4; G. 3·1-3 3.

B., etc. In matrass gives off water and turns yellowish; with a strong heat yields a white crystalline sublimate; on C melts to a grey magnetic slag with metallic lustre; gives off strong alliaceous fumes; soluble in HCl; partly soluble in KHO, the residue turning brown.

Comp. Hydrated arseniate of iron. A Cornish specimen yielded the following results to Damour:—

Arsenic anhydride.....	51·06
Peroxide of iron	32·74
Water	15·68
Total.....	99·48

With arsenic anhydride 49·8 per cent., peroxide of iron 34·7 per cent., and water 15·5 per cent. the formula may be written $\dddot{Fe}_2\dddot{As}_2\dot{4}H_2$ or $FeAsO_4+2H_2O$ or As_2O_4 Feo''_2+4OH_2.

Loc. Huel Muttrell, Huel Unity, Huel Gorland, Carharrack, and Tincroft (Phillips's Mineralogy, 1823, p. 321); recently in minute pale greenish blue crystals, on calcedony, from Pednandrea; St. Austell, lining cavities ("vugs") in tin lodes, in pale bluish-green radiating groups; Crinnis. Found also in France, Germany, Brazil, and other foreign localities.

Obs. It may be readily distinguished from the arseniates of copper, some of

which it much resembles, and with which it is often associated, by its blowpipe re-actions.

Angles.

M M′ =	98°	02′	M r =	145°	29′
M a	130	59	r r′	114	34
M b	130	09			

Sectile. Those minerals are termed *sectile* from which when cut with a knife the fragments do not fly away in powder. They are midway between brittle and malleable. *Ex.* Chalcocite.

Selenite. See Gypsum.

SENARMONTITE.

Cubic; usually in octahedrons, like Fig. 1, more or less modified; brittle; fracture uneven or lamellar; transparent to translucent; lustre resinous to adamantine; colourless; streak white; H. less than 3; G. 5·2-5·3.

B., etc. In matrass sublimes completely with a strong heat, depositing a white sublimate; on C volatilizes, and deposits a white crystalline coating; in R F is reduced to a brittle metallic bead, especially if mixed with soda or cyanide of potassium; tinges the flame green; soluble in Aqua Regia, but precipitated from the solution on addition of much water; with H_2S yields an orange red precipitate.

Comp. Anhydrous oxide of antimony. ... Sb_2 or Sb_2O_3 with, when pure, antimony 84·3 per cent. and oxygen 15·7 per cent.

Loc. Some of the antimony mines in the east of the county, on Jamesonite, with Bleinierite. It was first observed by Mr. Davis, of the British Museum, who found it in opaque regular octahedrons in a cavity of Jamesonite, accompanied with Bleinierite and minute crystals of Cerussite, but the author has since found it on specimens of his own.

Obs. It is best distinguished from Valentinite by its crystalline form.

SERPENTINE.

[Ophiolite. Ophite; &c.] Amorphous; massive; fibrous, foliated, granular, or compact; sectile; tough; fracture conchoidal, uneven, or splintery; translucent to nearly opaque; lustre resinous, vitreous, glimmering, or dull; various shades of green, red, brown, yellow, or nearly white; often mottled, and containing disseminated crystals of Bronzite or Diallage, and particles of chromite or other minerals; streak white, or slightly tinged as the colour; H. 2·5-4 (5·5 Bowenite); G. 2·4-2·6.

Var. The following are the chief of those described by Dana and others, some are, perhaps, distinct *species*:—

1. Massive:—

a. Noble or Precious Serpentine has a rich oil-green colour and considerable lustre. It is translucent, even in thick pieces. H. 2·5 to 3·0.

b. Retinalite is honey-yellow to light oil-green; H. 3·5; G. 2·47 to 2·52.

c. Common Serpentine is sub-translucent, or nearly opaque; the colours are often dull red or brown; H. 4·0.

d. Porcellaphite is earthy; very soft when first obtained; smooth porcellanous fracture; H. 3·5; G. 2·48.

e. Bowenite. Apple-green to greenish-white; fine granular structure; H. 5·5-6; G. 2·59-2·79.

2. Lamellar:—

a. Antigorite. Thin, easily separable laminæ; translucent or semi-transparent; smooth, but not unctuous; H. 2·5. It will sometimes cleave into rhombic prisms.

b. Williamsite. Apple-green; H. 4·5; G. 2·59-2·64.

3. Foliated:—

a. Marmolite. Thin foliæ, brittle; easily separable, or passing into an almost compact variety; lustre pearly; greenish-white or bluish; G. 2·41.

b. Thermophyllite. Small scaly aggregations; light brown, yellow, or silvery-white; lustre of cleavage pearly; H. 2·5; G. 2·61.

4. Fibrous:—

a. Picrolite. Almost columnar; not flexible; not often easily separable; long splintery fracture; dark green, greenish-grey, or brown. Metaxite is very similar, but separable into brittle greenish-white columns.

b. Chrysotile occurs in easily separable flexible fibres of a greenish-white, yellow, or brownish color, and silky or submetallic lustre; G. 2·2. It includes much of the so-called asbestos of serpentine rocks.

Very many other varieties are described, mostly from their external character alone. Some writers include Schiller-Spar or Bastite with Serpentine.

B., etc. In matrass always gives off water, and usually darkens; on C turns white; fuses at 4, or is infusible; with Co often indicates Mg; with borax or micro. yields reactions for Fe, Ni, or Cr; decomposed by HCl or H_2SO_4, leaving powdery or slimy silica.

Comp. Hydrated silicate of magnesia and various other bases, with from 11·0 to 16·0 per cent. of water, 39·0 to 44·0

per cent. of silica, and 30·0 to 44·0 per cent. of magnesia. Of the following analyses a. and b. are of dark green serpentine from the Lizard district. "The specimen is of a very dark green colour, in places verging upon black; it is thickly spotted with red, and has a coarsely granular structure. . . . massive, without any indication of foliation." "The microscope shows this rock to consist of a crypto-crystalline base, spotted by oxide of iron, &c., and enclosing indistinct green or yellowish-brown crystalline forms, pseudomorphs after pyroxene?" (J. A. Phillips, Phil. Mag., Feb., 1871):—

	a.	b.
Silica	38·86	38·58
Alumina	2·95	3·06
Ferric oxide	1·86	1·95
Ferrous oxide	5·04	5·10
Chromic oxide	0·08	0·08
Oxide of nickel	0·28	0·30
Oxide of manganese	trace	trace
Lime	trace	trace
Magnesia	34·61	34·52
Potash	0·33	0·30
Soda	0·77	0·76
Water	15·52	15·52
Total	100·30	99·97
Sp. gr.	2·59	2·59

With 43·7 per cent. of silica, 43·3 per cent. of magnesia, and 13·0 per cent. of water the formula may be written

$3Mg2Si2H_2$ or $2MgSiO_3 + MgH_2O_2 + H_2O$ or $Si_2Mg''_3Ho_2 + OH_2$.

A dark green serpentinous *rock* from Clickor Tor yielded to the same chemist:—

	a.	b.
Silica	36·60	38·80
Titanic acid	trace	trace
Phosphoric acid	trace	trace
Alumina	17·58	17·60
Ferric oxide	14·98	15·10
Ferrous oxide	4·52	4·50
Chromic oxide	0·14	0 14
Oxide of manganese	trace	trace
Lime	5·04	4·92
Magnesia	5·97	6·04
Potash	trace	trace
Soda	0·84	0·85
Water	10·66	10·46
Total	98·43	98·41
Sp. gr.	2·77	2·77

Mr. Phillips observes:—"The microscope shews this to be a highly metamorphosed rock, consisting of an amorphous matrix porphyritically enclosing yellowish-brown or green patches with indistinct crystalline forms, which are evidently pseudomorphs. There are also many black grains of magnetite, and crystals of some pyroxenic mineral—probably Schiller-spar or diallage (*ibid*).

Loc. Cadgwith, Kynance, Goonhilly Downs, Coverack, and many other localities in the Lizard district yield good specimens; Duporth, west of Charlestown; Tregarthen; Gorran; St. Cleer and Clickor Tor, near Liskeard; Pollaphant, near Launceston; &c. It occurs also in Anglesea, Scotland, Ireland, and many foreign localities.

Obs. Serpentine should, perhaps, be regarded rather as a *rock* than a *mineral*. It often contains veins of steatite or calcite, and its joints often contain native copper. Crystals of Diallage or Bronzite, and minute particles of Chromite, Magnetite, Pyrites, and other minerals are often disseminated through it.

Siderite. See Chalybite.

Silicates. Compounds of silica with various metallic oxides are so called. They are very numerous, and often very difficult to distinguish from each other by any means short of chemical analysis.

Dana divides the silicates into groups according to the oxygen ratio for the "bases" and silica, into—

	Base.	Silica.
1. Uni-silicates	= 1	: 1
2. Bi-silicates	= 1	: 2
3. Sub-silicates	= 1	: $\frac{3}{2}$, $\frac{1}{2}$, $\frac{3}{4}$, &c.

In the blowpipe or *pyrognostic* examination of silicates the chief points to be noted are:—

1. Whether moisture is given off on heating in matrass (hydrated silicates).

2. Whether the moisture has an acid reaction (Fluorine) or alkaline (probably some *altered* mineral). For fluorine, test specially with "Brazil-wood paper," and also observe whether the inside of the tube is roughened, &c.

3. Whether the specimen is fusible when heated on charcoal, and in what degree, or remains infusible. (If it becomes magnetic, *iron* is indicated; such silicates are usually fusible).

4. Those which leave a white or nearly white residue after heating on charcoal, or in forceps, may be treated with Co. for detection especially of alumina and magnesia. If a blue colour is produced, *alumina* is indicated; if pink or red, *magnesia*; if green, *zinc*.

5. When the specimen is neither colourless nor nearly white after strong heating, it should be tested for metallic oxides by means of borax or micro.

6. Silicates of copper (Chrysocolla and Dioptase) will yield a bead of copper if treated with soda.

7. Sulphur may be detected in silicates by fusion with pure soda, after which the moistened assay is to be laid upon a polished plate of silver, or silver coin, when a dark spot will be produced if sulphur is present.

8. In forceps observe whether the tip of the OF is coloured (Soda, Potash, Lithia, Baryta, Strontia, &c.)

9. For fusibility try both OF and RF. Many silicates which are infusible in OF are fusible in RF by the peroxides changing to protoxides.

10. Many silicates are soluble in HCl if finely powdered, except a quantity, more or less, of silica, which separates as a gelatinous mass or slimy powder.

11. Nearly all silicates effervesce when heated with soda. Most are freely soluble in borax, but leave a skeleton of silica if heated with micro. Upwards of 40 of the Cornish and Devonshire minerals are silicates. A few, such as Orthoclase and Chlorite, are very common; but very many, as Topaz, Beryl, Stilbite, &c., are extremely rare.

Silicate of Manganese. See Rhodonite.

Silicate of Tin. A massive and crystallized pseudomorph after Quartz, from Huel Primrose, St, Agnes (J. Garby, Trans. R. G. S. C., vol VII., p. 85).

Siliceous Oxide of Copper. "Has been found at South Basset, imbedded in granite close to the vein, or in a quartzose rock occurring in the vein. It is black, with a flat conchoidal fracture, very much resembling flint, and of equal hardness. Before the blowpipe a button of pure copper is, without much difficulty, produced, leaving a siliceous skeleton of great whiteness." (J. Garby, Trans. R. G. S. C., vol. VII., p. 89.) What mineral is here referred to it is difficult to say, as the characters set down do not agree with those of any of the recognised Cornish minerals.

SILVER.

[Native Silver.] Cubic; sometimes in cubes or octahedrons variously modified (Figs. 1, 2, 8, 9, 10, 11, &c.); often macled; more usually arborescent, filiform, or reticulate; sometimes massive; malleable; fracture hackly; opaque; lustre metallic; silver-white, but often covered with a yellow, brown, or black tarnish; streak light and shining; H. 2·5-3·0; G. 10·1-11.

B., etc. In matrass no change; on C fuses readily to a very bright white metallic bead, depositing a dark red coating on the charcoal; insoluble in HCl; soluble in HNO_3; the addition of HCl re-precipitates it as a white curdy chloride, which is soluble in ammonia.

Comp. The purest specimens almost pure silver. No analysis of a British specimen is known to the author.

Loc. Fine specimens were formerly obtained, associated with other silver ores, at Levant; Huel Herland, Gwinear, in a soft rock; Huel Alfred and Huel Ann, Phillack; West Huel Darlington: Dolcoath; North Dolcoath; Huel Basset; Huel Mexico; Huel Golden Consols; Great Retallack; Crinnis; Huel Ludcott, filiform, with stephanite, recently; Fowey Consols; Holmbush; Huel Duchy; Huel St. Vincent; Huel Brothers; Willsworthy Mine, near Tavistock, with erythrite and chalcopyrite; Combemartin, in small filaments with galena. It occurs in most foreign localities of silver ores.

Obs. It may be readily distinguished from all other minerals by the reactions given above.

Angles.

o o = 109° 28′ a a 90° 00′
o a 125 16 &c.

Silver Black, Silver Glance, Silver Mulm. See Argentite.

Silver White Cobalt. See Cobaltite.

Slate Spar. See Calcite (Schiefer-Spar).

SMALTITE.

[Smaltine. Tin-white Cobalt. Arsenical Cobalt.] Cubic; in octahedrons or cubes variously modified (Figs. 1, 2, 8, 16, 18, &c.); sometimes macled; also reniform, botryoidal, arborescent, reticulate, disseminated, or massive; brittle; fracture uneven; opaque; lustre metallic; splendant to glimmering, or dull; tin-white to steel-grey; often a dark grey or iridescent tarnish; streak black, or very dark grey; H. 5·5-6; G. 6·4-7·7; yields an alliaceous odour when broken.

Var. Smaltite is the pure cobaltic variety; G. 6·3-6·6.

Chloanthite is a variety in which the Co is largely replaced by Ni; G. 7·7·7. It is often described as a distinct species.

B., etc. In matrass gives a white crystalline sublimate; on C fuses at 1 to a grey brittle bead of metallic appearance; gives off an alliaceous odour, and deposits a white coating on the charcoal; with borax or micro. yields a deep blue bead in both flames; soluble except arsenic in HNO_3, forming a pink (Smaltite) or green (Chloanthite) solution.

Comp. Anhydrous arsenide of cobalt. No analysis of a British specimen is known to the author. With cobalt = 28·23 per cent. and arsenic = 71·77 per cent. the formula may be $CoAs_2$.

Loc. Botallack (qy. cobaltite); Wherry Mine; Huel Herland; Dudman's Mine, Illogan; Roskrow United, Ponsanooth; Huel Sparnon, on quartz, arborescent and reticulated; a solid mass of cobalt ore, probably smaltite, was raised in Huel Sparnon about the year 1820, which weighed 1,333 lbs. (Man. of Min. Truro, 1825, p. 52); East Pool, recently, massive; Pednandrea; Dolcoath; St. Austell Consols; Polgooth; Huel Trugoe, near St. Columb Major; Huel Huckworthy, Sampford Spiney; &c. It is also found in considerable quantities in Germany and other foreign localities.

Obs. It may be best distinguished from cobaltite by the grey colour of the crystals, or of a fresh fracture, the absence of distinct cleavage, and the absence or small proportion of sulphur.

Angles.

o o =	109° 28′	a a =	90° 00′
a o	125 16	a d	144 44

&c. Mostly the same as Pyrites.

Smaragd. Smaragdus. See Beryl.

Smaragdite. A grass-green variety of pyroxene. Said to have been found at Coverack (J. Garby, Trans. R. G. S. C., vol. VII., p. 76).

Smell. A character of but little importance in determinative mineralogy. Chrysocolla may often be distinguished from malachite by its earthy smell when breathed upon. See also Odour.

SMECTITE.

[Fuller's Earth.] Amorphous; massive; sectile; opaque; glimmering or dull; white, grey, green, or brown; streak white, shining; unctuous; non-adherent; softens if placed in water; very soft; G. 1·2-2·1.

B., etc. In matrass gives off much water; on C infusible (dark varieties fusible); decomposed by HCl.

Comp. Hydrated silicate of alumina, magnesia, iron, lime, &c., of very uncertain composition. Rather a rock than a mineral.

Loc. Carn Brea, in a copper lode? (J. Garby, Trans. R. G. S. C., vol. VII., p. 76). A similar mineral mass was found at Huel Penrose, Sithney, a few years ago.

Sooty Silver Ore. See Argentite (Silver Black).

Solubility. A character of very general application and much importance in the discrimination of minerals. A few minerals are soluble, more or less readily, in water. These may be at once known by their possessing a distinct *taste*.

To ascertain the solubility of a mineral, a little of its powder should be placed in a *test-tube* and treated with a few drops of the solvent. For general analysis, substances which have not a metallic appearance should be treated with various solvents in the following order until the proper solvent is found.

1. Water.
2. Dilute hydrochloric acid.
3. Strong hydrochloric acid; warmed if necessary.
4. Dilute nitric acid.
5. Strong nitric acid; warmed if necessary.
6. Aqua Regia.
7. Dilute sulphuric acid.
8. Strong sulphuric acid.

In some cases special solvents, such as caustic potash, caustic soda, ammonia, hydrofluoric acid, &c., may be used. A watch-glass is, for very minute quantities, sometimes more convenient than a test-tube.

To ascertain whether any portion of the substance is dissolved in cases where it is not *freely* soluble, a drop of the solvent should be evaporated to dryness on clean glass, or platinum foil, when, if there be any fixed residue, it will be evidence of a certain amount of solution, as these solvents are all volatilized completely by heat: unless, indeed, they be impure.

In the case of substances of metallic appearance much time may often be saved by using nitric acid—dilute or strong—*before* the other solvents.

Any *effervescence, peculiar odour, change of colour*, or *appearance* should be carefully noted. Any undissolved or altered insoluble residue must be carefully examined by the blowpipe and other means.

Many sulphides, arsenides, or silicates leave residues which are easily recognised by their appearance or by a few simple tests.

Solvents. See Solubility.

Spar. A Cornish term for Quartz. The true spars are such minerals as Calcite, Dolomite, Chalybite, Fluor Spar, Barytes, Celestite, &c.

Sparable Tin. See Cassiterite.

Sparry Iron Ore, Spathose Iron. See Chalybite.

Spear Pyrites. See Marcasite.

Specific Gravity. This term is used to express the weight of a substance compared with some other substance. In mineralogy distilled water at the temperature of 60° F. or 15·55 C. or sometimes 4° C. is taken as the standard. Thus the sp. gr. of water is said to be 1; that of silver about 10½; meaning that silver is about 10½ times heavier than an equal bulk of water.

The specimen to be examined should be free from foreign matter, from disintegration, or decay (unless it is the sp. gr. of such a specimen which is especially wanted), and should contain no cavities; when these are suspected the mineral should be powdered.

The following methods will suffice for most minerals, the first for such as are in compact masses, the second for small fragments or fine powder:—

1st Method:—

a. Weigh the fragment as carefully as possible in an ordinary pair of scales.

b. Suspend it by a horse-hair from below the scale-pan, let it dip under the surface of water contained in any convenient vessel, and again weigh it. It will be found that fewer weights will be sufficient to balance it.

c. Substract the weight indicated in b. from that in a.; the difference will be the weight of a quantity of water equal in bulk to the specimen.

d. Divide the weight a. by the difference, c.; the quotient will be the specific gravity.

Example 1—A specimen of white calcedony, from Huel Kitty, St. Agnes:—

a. Weight in air	43·1
b. Weight in water	27·2
c. Difference	15·9

43·1 ÷ 15·9 = 2·71, the sp. gr. of the specimen.

Example 2—Green fluor, from Gwennap:—

a. Weight in air	135·3
b. Weight in water	92·0
c. Difference	43·3

$\frac{135·3}{43·5} = 3·125$, the sp. gr. of the specimen.

2nd Method:—

Procure a small *specific gravity* bottle, a light glass bottle with a mark on the neck; or, better, a stopper perforated with a fine hole.

a. Fill it with water, insert the stopper, and wipe it dry. Make a counterpoise the exact weight of the bottle so filled.

b. Weigh off any convenient quantity of the substance to be examined, such that it may be afterwards introduced into the bottle.

c. Put the weighed fragments carefully into the bottle, taking care that none be lost. Of course, as the bottle was previously *full* of water, some will now run out. Having again inserted the stopper and wiped the bottle, it will be found that the counterpoise, together with a smaller number of weights than those mentioned in b., will be sufficient to balance it; the difference will be the weight of the displaced water, *i.e.*, of a bulk of water equal to the specimen.

d. Divide the weight of mineral in b by the difference; the result will be the sp. gr.

Example 3—Fine sand from Marazion. 301 grains were carefully weighed out. They were then introduced into a specific gravity bottle; counterpoised as described; when it was found that 185 grains were sufficient to produce equilibrium. Then the weight of mineral = 301 grains; weight when placed in bottle = 185 grains. Difference, or weight of an equal bulk of water = 116 grains. Then 301 ÷ 116 = 2·6 the sp. gr. required.

Specular Iron. See Hematite.

Sphene. See Titanite.

Sphenoid. A solid figure resembling a tetrahedron, but the sides of which are not *equilateral* triangles. The hemihedral forms of the tetragonal, rhombic, and oblique pyramids are called sphenoids.

The tetragonal sphenoid is bounded by four equal *isosceles* triangles.

The rhombic sphenoid is bounded by four equal scalene triangles.

The oblique sphenoid is bounded by four scalene triangles, two larger and two smaller.

Spherical. A term applied to those mineral specimens which occur in a form approximating to a sphere, as some varieties of Aragonite or Malachite. It is an extreme *mammillary* form.

Stalactites. The cylinders or cones which hang from the roofs of some caverns, especially limestone caverns, are so-called. They are deposited by the water which percolates through the roof. As it evaporates, the dissolved carbonate of lime remains behind and so forms a hanging mass.

Some have a granular, some a crystalline, fibrous, or radiating structure, while some are quite hollow. Fine stalactites of calcedony have occurred in many Cornish mines, especially at North Pool and Huel Alfred, many years ago; and quite recently at Pednandrea. At the latter locality some of the specimens are surrounded with minute crystals of ordinary quartz, so that they have been mistaken for *stalactitic quartz*.

Stalactites of hydrous oxide of iron are very common in the old workings of many mines.

Stalactites of sulphate of iron have occurred at Huel Prosper, in old workings.

Stalactites of psilomelane have occurred at Restormel Royal Iron Mines, associated with lithomarge.

Stalactitic Minerals which occur in forms resembling icicles are said to be stalactitic.

Stalagmites are formed in the same manner as stalactites, but they occur on the *floors* of caverns. Large dome-shaped masses are sometimes found in old workings, and in limestone caverns the cone-shaped stalagmites sometimes so ncrease in size as to meet and join the stalactites depending from the roof, so forming rude pillars.

Stanniferous. Containing tin.

STANNITE.

[Stannine. Tin Pyrites. Bell Metal Ore, &c.] Cubic? pyramidal? or amorphous; mostly occuring in compact or granular masses; sometimes disseminated; brittle; fracture uneven or granular; opaque; lustre metallic; steel-grey to iron-black; sometimes yellowish; streak black; H. 4; G. 4·3-4·6.

B., etc. In matrass decrepitates and gives off a yellow sublimate; in open tube gives off SO_2, and often deposits a white incrustation of SnO_2; on C fuses readily to a brittle magnetic bead, depositing a white incrustation; with borax yields the reactions for copper; decomposed by HNO_3, forming a green solution, with separation of S and SnO_2.

Comp. Anhydrous sulphide of copper and tin, with some iron. Many mineralogists regard it as an intimate *mixture* only of oxide of tin and chalcopyrite. Of the following analyses a. and b. are of specimens from St. Agnes, by Klaproth; c. is from St. Michael's Mount, by Mallet; d. from St. Michael's Mount, by Johnston; e. from Huel Rock, by Kudernatsch:—

	a.	b.	c.	d.	e.
Tin	34·0	26·5	26·85	31·618	25·55
Copper	36·0	30·0	29·18	23·549	29·39
Iron	2·0	12·0	6·73	4·791	12·44
Zinc	—	—	7·26	10·113	1·77
Sulphur	25·0	30·5	29·46	29·929	29·64
Gangue	—	—	0·16	—	1·02
Total	97·0	99·0	99·64	100·000	99·91

Loc. Botallack; St. Michael's Mount; South Huel Crofty, Carn Brea, and East Pool, recently; Barrier (?) Mine, Gwennap; Scorrier Consols; Huel Rock and Huel Primrose, St. Agnes; Stenna Gwynn; St. Stephens; Lanescot It has been found also in Ireland and in Germany.

STAUROLITE.

[Staurotide.] Rhombic; in six-sided prisms (Fig. 116, &c.); or in macles intersecting each other, as in Figs. 117, 118; brittle; fracture conchoidal or uneven; translucent to opaque; lustre vitreous to resinous; dull reddish-brown or black; streak white or greyish; H. 7-7·5; G. 3·4-3·8.

B., etc. In matrass no change; on C, in fine powder, fuses at 4 to a black or dark green slag; with borax slowly forms a dark green glass; with micro. a glass almost colourless; insoluble in HCl; partly decomposed by H_2SO_4.

Comp. Anhydrous silicate of alumina and iron. No analysis of a specimen from Devon or Cornwall has been made, but foreign specimens contain from 28 to 40 per cent. of silica, 44 to 53 per cent. of alumina, 14 to 18 per cent. of peroxide of iron, with, frequently, small quantities of manganese, lime, or magnesia.

Loc. It is said to have been found in the clay-slate of Cornwall and Devon (T. M. Hall, F.G.S., Min. Direct., pp. 52-63). The figures given may, perhaps, lead to its re-discovery.

Obs. It has been found in Scotland, Ireland, and many foreign localities, usually in mica-slate, talc-slate, or clay-slate, with garnet, kyanite, and tourmaline.

STEATITE.

[Saponite, Dana. Soapstone; &c.] Amorphous; massive; sometimes nodular; compact or foliated; sectile; fracture splintery, slaty, uneven, or flat conchoidal; translucent to opaque; lustre waxy, glimmering, or dull; white, or various tints of grey, yellow red, brown, green, blue, &c.; H. 1-2·5; G. 2·2-2·8; unctuous.

Var. The softer varieties are specially called Saponite.

B., etc. In matrass gives much water, and sometimes turns darker; on C fuses at about 4 to a vesicular glass or white enamel; some varieties infusible; with Co the infusible varieties often turn reddish; insoluble in HCl or HNO_3; decomposed by hot H_2SO_4, with separation of silica.

Comp. Hydrated silicate of magnesia and alumina. Of the following analyses a. and b. are by Klaproth, from the Lizard; c. and d. by Svanberg; e., by Houghton, from Gue Grease. a., c., and e. are given on the authority of Descloizeaux:—

	a.	b.	c.	d.	e.
Silica	45·00	48·00	46·8	42·19	42·28
Magnesia	24·75	20·50	33·3	30·57	29·70
Alumina	9·25	14·00	8·0	7·67	7·21
Peroxide of iron	1·00	1·00	0·4	—	—
Lime	—	—	0·7	—	—
Potash	0·75	—	—	—	—
Water	18·00	15·50	11·0	18·46	18·92
Total	98·75	99·00	100·2	98·80	98·11

With silica 50·4 per cent., magnesia 34·1 per cent., and water 15·5 per cent. the formula may be written $\dot{M}g\ddot{S}iH_2$ or $MgSiW_3+H_2O$ or $SiOMgo''+\dot{O}H_2$. In this case the alumina must be regarded as replacing part of the silica. Dr. Frankland gives the formula of steatite as $Si_4O_5Mgo''_3$, which is, perhaps, a variety of *talc*, since it is *anhydrous* and contains no *alumina*. Probably many *different* minerals have been described as steatite.

Loc. Kynance Cove, Mullion, Pednboar, Cadgwith, Coverack, and other parts of the Lizard district, in veins, in serpentine; near Trelowarren, in greenish-blue veins in olive-green serpentine; Penmare Point; "In a tin lode in Carnyorth Moor, and in small veins in slate to the south of Pendeen Cove;" "Botallack, in a tin and copper lode, with oxide of iron;" St. Ives; Cook's Kitchen (lithomarge?) St. Cleer, and near the Cheesewring; Pollaphant; Clickor Tor, in joints of impure serpentine, &c. It occurs also in Cumberland, Wales, Scotland, Ireland, and many foreign localities.

Obs. It is best distinguished from Lithomarge by the reactions for magnesia obtained by means of the blowpipe, or in humid analysis. It may be distinguished from Agalmatolite in the same manner, and by its inferior hardness.

Stellate. Occurring in the form of a star, as is often seen in specimens of Pyrolusite and other minerals.

STEPHANITE.

[Brittle Sulphuret of Silver. Black Sulphuret of Silver.] Rhombic; in tabular or short columnar crystals; or globular, massive, disseminated, or investing; sometimes drusy; brittle, or sectile; fracture imperfect conchoidal to uneven; lustre metallic; iron-black; streak the same; H. 2·5; G. 6·2-6·3.

B., etc. In matrass a white or yellowish sublimate; on C alone melts to a dark grey bead, and deposits a white incrustation; sometimes gives off an arsenical odour; with soda or borax RF yields a malleable bead of silver; decomposed by warm HNO_3, leaving oxide of antimony and sulphur undissolved; the solution yields a curdy precipitate on addition of common salt or HCl.

Comp. The author is not aware of any analysis of a British specimen, but a specimen from Schemnitz yielded to H. Rose 68·52 per cent. of silver, 0·64 per cent. of copper, 14·68 per cent. of antimony, and 16·42 per cent. of sulphur. With 69·7 per cent. of silver, 13·1 per cent. of antimony, and 17·2 of sulphur the composition will be Ag_9SbS_{10} or $6AgS+SbS_4$.

Loc. Huel Ludcott, recently, with fibrous native silver and beautiful half-inch cube-octahedrons of argentite, in brilliant crystals of 1½ lines long. (Davies' Geol. Mag.)

STIBICONITE.

[Stibiconise. Stiblite. Antimon-ochre in part.] Amorphous, brittle; fracture uneven or earthy; opaque; dull or glimmering; colour yellowish; streak yellowish-white, glimmering; H. 5·5 (?) Greg and Lettsom, and Bristow); G. 5·28.

B., etc. In matrass yields water; on C is readily volatilized, depositing a white coating on the support; with soda is easily reduced to a white brittle metallic bead; soluble in warm HCl.

Comp. Hydrated antimonic oxide. With antimony 71·2 per cent., oxygen 23·2 per cent,, and water 5·6 per cent., which is not far from the composition of some foreign specimens, the formula may be written $\dot{S}b_2H_2$ or $Sb_2O_5+H_2O$.

Loc. "The antimony ochre accompanying Bleinierite and Jamesonite, at Trevinnock, near Endellion, appears to be this variety." (Greg and Lettsom, p. 372.)

Stibine.
Stibium.
Stibnite. } See Antimonite.

STILBITE.

[Desmin. Foliated Zeolite. Sphærostilbite.] Rhombic; in modified prisms; (Figs. 108, 109), the faces often curved, striated, or rough; cleavages highly perfect, parallel to a; imperfect, parallel to b; often in groups of imperfect crystals, laterally aggregated; also massive; compact, columnar, or radiating; brittle; fracture uneven; semi-transparent to translucent; lustre vitreous, pearly on cleavage planes; white, grey, yellow, brown, red, &c.; streak white; H. 3·5-4; G. 2-2·2.

B., etc. In matrass gives off water; on C fuses with intumescence to a

blistered glass or enamel; with Co. turns blue; slowly but completely decomposed by HCl, leaving gelatinous silica.

Comp. Hydrated silicate of alumina and lime. The Cornish specimens have not been analysed, but foreign specimens yield about 56 per cent. of silica, 15·9 per cent. of alumina, 8·6 per cent. of lime, and 19·5 per cent. of water. With these proportions the formula may be written $\dddot{Al}_2Ca6Si + 7H_2$ or $Al_2 3SiO_3 + CaSiO_3 + 2H_2SiO_3 + 5H_2O$ or $Si_6O_6Al_2O^{iv}$ $Cao'' + 7OH_2$.

Loc. The rocks between Botallack and Huel Cock, "crystallized in flat four-sided prisms, with wedge-like summits," with Prehnite and Mesotype (J. Carne, Trans. R. G. S. C., vol. II). Found also in Scotland, Ireland, and many foreign localities.

Obs. It usually occurs in granitic, basaltic, or highly altered schistose rocks, or in cavities of amygdaloidal rocks; sometimes, however, in veins or "vugs."

Angles.

O a =	90°	00′	r r′ =	119°	16′
a b	90	00	O r	132	00
M a	132	52			

Stilpnosiderite. See Limonite.

Stream Tin. See Cassiterite.

Streak. The colour of the powder of a mineral, a character of very considerable value in discrimination. Thus Hematite may be distinguished from Limonite by the redness of its streak; Wolfram may be readily distinguished from Blende by its much darker streak. This test admits of being tried in cases where the sp. gr. cannot be easily determined, as in imbedded crystals, &c.

The colour of the *streak* is best determined by rubbing the specimen on a slightly roughened plate of white porcelain, when, if not too hard, some of it will be rubbed off. Very often a scratch with a knife suffices, or rubbing with a file, but the mark made in the mineral —the *scratch*—must then be distinguished from the colour of the abraded particles —the *streak*.

Striated. Minerals which have small channels on their crystalline surfaces are said to be *striated*. The striations are usually confined to certain planes, and are often of value in discriminative mineralogy. Thus in quartz the striations are horizontal, or across the prisms; while in topaz they are vertical, or lengthwise. They are produced by partial and interrupted changes in the crystalline form.

Structure. This term relates to the internal characters of minerals. It properly includes *cleavage*, and the various kinds of *fractures* produced when minerals are broken. They are often very characteristic. See page 34, *Cleavage*; and page 48, *Fracture*.

Sublimate. A vapour condensed to a solid. When fragments of Pyrites, or of many other minerals, are heated in a matrass, sulphur, &c., rises in vapour, and is condensed on the cool part of the tube, thus affording evidence of its presence. The colours of sublimates, appearance (crystalline or amorphous), and volatility are characters of importance.

Sub-phosphate of Alumina. See Wavellite.

Sulphates. Salts composed of sulphuric anhydride and a metallic oxide, or sulphuric acid, in which the hydrogen has been replaced by a metal. The sulphates occurring in the two counties are the following:—

Anglesite,	*Johannite,*
Barytes,	*Kalinite,*
Celestite,	*Langite,*
Gypsum,	*Linarite,*
Brochantite,	*Melanterite,*
Cyanosite,	*Woodwardite.*
Goslarite,	

Of these the first three are anhydrous, the rest are hydrous. Connellite is a sulphato-chloride.

Sulphate of Alumina and Potash. See Kalinite.

Sulphate of Barytes. See Barytes.

Sulphate of Copper. See Cyanosite, Brochantite, Langite, Woodwardite.

Sulphate of Iron. See Melanterite.

Sulphate of Lead. See Anglesite and Linarite.

Sulphate of Lime. See Gypsum.

Sulphate of Strontia. See Celestite.

Sulphate of Uranium. See Johannite.

Sulphate of Zinc. See Goslarite.

Sulphide. A non-oxidised compound of sulphur and any metal.

The chief sulphides occurring in the two counties are:—

Antimonite,	*Galena,*
Argentite,	*Jamesonite,*
Berthierite,	*Marcasite,*
Bismuthinite,	*Millerite,*
Blende,	*Molybdenite,*
Bournonite,	*Pentlandite,*
Chalcocite,	*Pyrites,*
Chalcopyrite,	*Pyrrhotite,*
Covellite,	*Stephanite.*
Brubescite,	

All the above are anhydrous. Besides these there are the following sulphantimonides and sulpharsenides:—

Cobaltite, *Polybasite*,
Fahlerz, *Pyrargyrite*,
Mispickel, *Tennantite*,

These are all anhydrous.

Sulphide of Antimony. See Antimonite.

Sulphide of Bismuth. See Bismuthinite.

Sulphide of Copper. See Chalcocite and Covellite.

Sulphide of Copper and Iron. See Chalcopyrite, Erubescite, and Fahlerz.

Sulphide of Iron. See Pyrites, Marcasite, and Pyrrhotite.

Sulphide of Iron and Antimony. See Berthierite.

Sulphide of Iron and Nickel. See Pentlandite.

Sulphide of Lead. See Galena.

Sulphide of Lead, Copper, and Antimony. See Bournonite.

Sulphide of Lead and Antimony. See Jamesonite.

Sulphide of Molybdenum. See Molybdenite.

Sulphide of Nickel. See Millerite.

Sulphide of Silver. See Argentite.

Sulphide of Silver and Antimony. See Stephanite.

Sulphide of Tin, Copper, and Iron. See Stannite.

Sulphide of Zinc. See Blende.

SULPHUR.

Rhombic; in modified pyramids, often macled; some of the planes striated; also drusy, globular, reniform, stalactitic, investing, or massive; brittle; fracture conchoidal or uneven; transparent to opaque; lustre resinous to adamantine; yellow, or sometimes reddish, brownish, greyish; streak light yellow; H. 1·5-2·5; G. 2·0-2·1.

B., etc. In matrass sublimes in brownish-yellow drops; on C burns away with a blue flame and a strong sulphureous odour; insoluble in HCl; scarcely acted upon by HNO_3.

Comp. The purest specimens almost pure sulphur.

Loc. Formerly at Nangiles, in cavities of Pyrites, as a greyish pulverulent deposit (J. Garby, Trans. R. G. S. C., vol. VII., p. 92); Poldice; more recently by Mr. Davis, of the British Museum, and by Mr. Talling, of Lostwithiel, in minute crystals, in the neighbourhood of Liskeard or Lostwithiel.

Obs. Sulphur is often found as a greenish-yellow efflorescence on the ground in Carnon Valley after a long continuance of dry weather. The author saw it in many large patches in the summer of 1869 and also in 1870.

Sulphuret. See Sulphide, with which it is synonymous.

Swamp Ore, Swampy Iron Ore. See Limonite (Bog Iron Ore).

Swimming Quartz. See Quartz (Floatstone).

Symbols. See Table of the Elements in Part I.

T.

Tabular. Crystals which are nearly flat are said to be tabular, whatever the system of crystallization. The term is also used to express a variety of structure. Thus minerals which will cleave into plates of a moderate degree of thinness only, as Barytes, Wolfram, &c., are said to be *tabular*.

TALC.

[Soapstone, in part. Talc Steatite. Lapis Ollaris.] Hexagonal; very rarely in six-sided tables, with perfect cleavage; sometimes in thin pearly six-sided plates; more usually massive; foliated, slaty, granular, earthy, or compact; sectile, thin laminæ flexible, but not elastic; semi-transparent to opaque; lustre pearly or waxy; light-green, white, reddish, brownish; streak white, or much paler than colour; unctuous; H. 1-1·5; G. 2·6-2·8.

B., etc. In matrass usually gives off a *little* water; on C hardens, but remains infusible; often glows with an intense light in a strong flame; sometimes exfoliates or falls to pieces; treated with Co turns reddish; with micro. forms a turbid glass, leaving a siliceous skeleton; insoluble in HCl or HNO_3.

Comp. Silicate of magnesia, with a *little* alumina and a small proportion of water. No analysis of a specimen from Cornwall or Devon is known, but a Scottish specimen yielded to Lychnell, 64·53 per cent. of silica, 27·70 per cent. of magnesia, 6·85 per cent. of protoxide of iron (a much larger proportion than usual), and no water at all. With silica 69·3 and alumina 30·7—regarding the oxide of iron as accidental—the formula would be $3\ddot{S}i2Mg$ or $2MgSiO_3+SiO_2$ or $Si_3O_4Mgo''_2$.

Loc. It is said to have occurred at St. Just; it is common at Kynance Cove, and other places in the Lizard district; St. Stephens; Beam Mine; Stenna Gwynn; and St. Cleer.

Obs. Steatite may, possibly, have been mistaken for Talc in the localities

above mentioned. Steatite usually contains a considerable quantity of *water* and *alumina*, by the presence of which it may be readily distinguished.

Tallingite. A variety of Atacamite found at Botallack, and analysed by Professor Church (Journ. Chem. Soc. II., III., p. 77). See Atacamite.

Taste. A character of very limited application in the discrimination of minerals, but very precise when applicable. Thus, *cyanosite*, *goslarite*, *melanterite*, *halite*, *kalinite*, &c., may be at once recognised by their taste. The first three have what is called a *metallic* taste; the others are *saline*.

TAVISTOCKITE.

[Soft Wavellite?] Rhombic? in small stellate aggregations of microscopic acicular crystals; brittle; transparent to translucent; lustre pearly; white; H. and G. unknown.

B., etc. In matrass gives off water; on C incandesces and becomes opaque, tinging the flame greenish; with Co turns blue; with borax forms a colourless bead; soluble with difficulty in HCl or HNO_3.

Comp. Hydrated phosphate of alumina and lime, as appears from the following analysis of a recently-discovered specimen from the neighbourhood of Tavistock by Professor Church (Journ. Chem. Soc., II., III., p. 263, 1865):—

Phosphoric anhydride	30·36
Alumina	22·40
Lime	36·27
Water	12·00
Total	101·03

Loc. Near Tavistock, in cavities on Quartz, with Pyrite, Chalcopyrite, and Churchite. The so-called *Wavellite* from Stenna Gwynn was probably this mineral, as it was certainly not the true Wavellite. It is described by Mr. Michell as follows:—"Soft Wavellite, an assemblage of minute crystals, attached to tufts of quartz, radiating sometimes like a fine powder of down; colour white" (Man. of Min. Truro, 1825, p. 157). It was accompanied by Fluor, Cassiterite, and Chalcopyrite in granite, while the true Wavellite is on slate.

TENNANTITE.

Cubic; in small dodecahedrons, octahedrons, tetrahedrons, cubes, &c., usually more or less modified (Figs. 3, 8 to 15, 37, 42, &c.); sometimes macled; rarely massive; brittle; fracture uneven, imperfectly conchoidal, or laminated; opaque; lustre metallic; lead-grey to iron-black; streak dark reddish-brown; H. 4; G. 4·3-4·5.

B., etc. In matrass decrepitates and yields a reddish sublimate; on C burns with a blue flame, deposits a white incrustation, and melts to a dark brittle magnetic bead or slag, giving off sulphureous and arsenical odours; with borax and micro. yields reactions for Cu and Fe; after well roasting yields, with soda, a bead of copper, but not readily; soluble in HNO_3.

Comp. Sulpharsenide of copper and iron. Of the following analyses a. is by Klaproth, of a specimen from Tresavean; b. by Kudernatsch, from the same locality; c. by Phillips, from Cornwall; d. is the composition of an arsenical Fahlerz, by Hemming, from Gwennap, introduced for comparison:—

	a.	b.	c.	d.
Copper	47·70	48·94	45·32	48·40
Iron	9·75	3·57	9·26	14·20
Arsenic	12·46	19·10	11·84	11·50
Sulphur	30·25	27·76	28·74	21·80
Silver	—	trace	—	—
Silica	—	0·08	—	5·00
Total	100·16	99·45	95·16	100·90

With copper 42 6 per cent., iron 13·2 per cent., arsenic 17·7 per cent., sulphur 26·4 per cent. the formula may be written Cu_3FeAsS_7 or $2(Cu_2Fe)S_4 + As_2S_3$. With a substance of such variable composition many other formulæ might be made to serve.

Loc. Dolcoath; North Roskear; Cook's Kitchen; Tincroft; Carn Brea; Huel Jewel; Huel Unity; Tresavean; Trevascus; East Relistian, &c., but not recently.

Obs. It is sometimes regarded as an *arsenical* Fahlerz.

Angles.

o o (Fig. 42) =	70° 32′	a a =	90° 00′
o o′	109 28	d d	120 00

&c.

Mr. Greg's collection contained specimens from Cornwall exhibiting the following forms, viz., d; o d; a d; m d; a o d; o o′ d; a o d n.

Tetrahedrite. See Fahlerz.

Tetrahedron. A solid four-sided figure. The regular tetrahedron is bounded by four equal equilateral triangles (Fig. 33).

Tile Ore. See Cuprite.

Tin Hematite. See Cassiterite (Woodtin).

Tin Ore. } See Cassiterite.
Tin Oxide. }

Tin Pyrites. See Stannite.

Tin Stone. See Cassiterite.
Tin-white Cobalt. See Smaltite.
Titanite. See Ilmenite.

TITANITE.

[Sphene.] Oblique; in modified prismatic or tabular crystals, often macled, or imbedded; sometimes granular, foliated, or disseminated; brittle; fracture conchoidal or uneven; translucent to opaque; lustre resinous, vitreous, or adamantine; grey, yellow, brown, green, black; dichroic; streak greyish; H. 5-5·5; G. 3·4-3·6.

B., etc. In matrass unchanged; on C swells up, or fuses slightly on thin edges to a dark glass; with borax forms a transparent yellow glass; soluble, except silica, in HCl; the solution if boiled with tin-foil becomes violet; decomposed by H_2SO_4 with deposition of *gypsum*.

Comp. Silicate and titanate of lime. With titanic anhydride = 41·33, silica 30·45, lime 28·22, which is not far from the composition of some foreign specimens, the formula may be written $CaSiO_3+SiO_2+CaTiO_3+TiO_2$.

Loc. Virtuous Lady Mine, in small yellowish crystals, imbedded in chlorite with anatase. Found also in Scotland, Wales, and Ireland, at many localities, but always rare, and usually in *gneiss* or *syenite*. It also occurs at many foreign localities.

TOPAZ.

Rhombic; in modified prisms, usually striated longitudinally, attached or imbedded (Figs. 148, 149); perfect cleavage parallel to O; sometimes in druses; rarely massive, or disseminated, in roundish grains, in veins or water-worn pebbles; brittle; fracture uneven or conchoidal; transparent to translucent; lustre vitreous to pearly; colourless, yellow, brownish, bluish, or greenish; streak white; H. 8; G 3·4-3·6; pyro-electric.

B., etc. In matrass no change; on C infusible, or fusible at 4 to a blistered enamel; with borax melts slowly to a clear transparent glass; with Co turns blue; with micro. in a matrass yields distinct fluorine reactions; insoluble in HCl or HNO_3; partly decomposed by H_2SO_4, with evolution of HF.

Comp. Anhydrous silico-fluoride of alumina. No British specimen has been analysed, but foreign specimens yield about 38 per cent of silica, 56 of alumina, and 16 of fluorine. All the formulæ given are exceedingly long, and useless as aids to the memory. Professor Frankland gives $Si_3(Al_2O_5F)^{v}(Al_2O_4F_2)^{iv}(Al_2O_4F)^{iii}$. Mr. Gregor first detected *potash* in the Cornish topazes (Ann. Phil., vol. VIII., p. 276).

Loc. St. Michael's Mount, in colourless or bluish crystals, much like Fig. 148, with lepidolite, tourmaline, cassiterite, fluor, apatite, &c., in the joints of the granite; Lamorna Cove, under similar circumstances; Constantine and Mabe, in small bluish crystals in granite; Huel Kind, Trevaunance, and Seal Hole Tin Mines, St. Agnes, in slate; St. Kea; St. Austell Hill Mine, in a lode, in granite, with cassiterite, quartz, tourmaline, felspar, &c. It is also said to have been found on Lundy Island. It occurs at a few localities in Scotland and Ireland, but is never plentiful. Very fine specimens occur at many foreign localities, especially in Saxony and Brazil.

Obs. It may be readily distinguished from quartz and other minerals which somewhat resemble it by its perfect and easily obtained basal cleavage, longitudinal striation, and hardness. It mostly occurs associated with other minerals containing fluorine, in granitic or schistose rocks.

Angles.

M M′ =	124°	19′	O k =	116°	12′
M O	90	00	O i	119	05
M a	117	50	k i	155	13
O a	90	00	k k′	130	27
O e	147	41	l l′	86	52
O n	136	29	o o′	141	07
O y	117	47	n n′	87	01
O o	134	32			

TORBERNITE.

[Uranite, in part. Chalcolite.] Pyramidal; usually in thin tables, more or less modified on the edges and angles (Figs. 74, 75, 76, 84); perfect basal cleavage (O); sectile; transparent to translucent; lustre vitreous to adamantine, pearly on cleavage; green of various shades, sometimes yellowish-green; streak light green; H. 2-2·5; G. 3-3·6.

B., etc. In matrass gives off water and becomes dark and opaque: on C swells slightly and fuses to a dark mass, which, on cooling, presents a crystalline surface; with soda yields with some difficulty a small bead of copper; with borax and micro. yields Cu reactions; soluble in HNO_3, forming a green solution.

Comp. Hydrated phosphate of uranium and copper. Of the following analyses of Cornish specimens a. is by Phillips; b. by Berzelius; c. from Gunnislake, by Werther; d. by Pisani;

e. by Prof Church (Chemical News, XII., 183):—

	a.	b.	c.	d.	e.
Phosphoric anhydride..	16·00	15·57	14·34	14·00	13·94
Oxide of uranium.....	60·00	61·39	59·03	59·67	61·00
Oxide of copper.....	9·00	8·44	8·27	8·50	8·56
Water	14·50	15·65	15·39	15·00	14·10
Silica.....	—	—	0·49	0·40	—
Earthy mat..	—	—	0·41	—	—
Arsenic anhydride.....	—	—	—	—	1·96
Lime.....	—	—	—	—	0·62
Total....	99·50	100·45	97·93	97·57	100·24

With oxide of uranium = 61·2 per cent., oxide of copper = 8·4 per cent., phosphoric anhydride 15·1 per cent., and water 15·3 per cent. the formula may be written $\dot{Cu}, 2\dot{U}_2, \dot{P}_2+8H_2$ or $CuO, 2U_2O_3, P_2O_5+8H_2O$ or $2U_2O_3, P_2O_5+CuH_2O_2+7H_2O$.

Loc. Huel Edward, St. Just, formerly, with autunite; Huel Trenwith; Providence Mines; Huel Buller, in dark green crystals; South Huel Basset, with autunite; South Huel Frances; Tincroft; Tolcarne, with autunite; Huel Gorland; Huel Unity; Ting Tang; Huel Jewell; St. Agnes; Stenna Gwynn, in small pale crystals, with fluellite; St. Stephens; Huel James Copper and Iron Mine, Withiel, in very fine dark green crystals, in gozzan; Gunnislake, very fine, formerly, in large thin aggregated plates, with smoky grey quartz, at about 90 fathoms from the surface. Many years ago very many specimens were raised and sold from this locality.

Bedford United Mines, near Tavistock, formerly, in small crystals.

It also occurs in Ireland, and in many foreign localities.

Obs. It may be distinguished from chalcophyllite by the form of the crystals and the absence of arsenic; from autunite by its green colour and Cu. reactions. J. Garby states that specimens of "Chalcolite" were found at "Huel Basset and Huel Buller which were very phosphorescent when first discovered, so that after the lights were extinguished many of the crystals might be discovered *in situ*." (Trans. R. G. S. C., VII., p. 86.)

Angles.

O M =	90°	00′	O s =	140°	07′
M M	90	00	O o	136	45
a a	90	00	O r	111	45
O a	90	00	O u	109	34
M a	135	00	O v	107	35
O t	134	50			

The Cornish forms observed are, according to Greg and Lettsom, e, eO, evO, evOt, rO, rsO, rsOa, rsOt, rvOt, oO, uoO, xoO, MoO, SuO, sOa, MrO, MrOa, MrsOt, MusOl, MusOa. Most of these were in Mr. Greg's collection.

Touch. A character of some importance in the discrimination of some minerals. Thus Graphite feels *unctuous*, while Pyrolusite feels *harsh*.

Tough. Not easily broken. *Ex.* Hornblende. The term is used in contradistinction to *brittle*.

TOURMALINE.

[Schorl.] Hexagonal; in longitudinally striated prisms, usually imbedded, or lining nests or "vugs;" often acicular and interwoven; sometimes in distinct crystals, the termination at least like those shewn in Figs. 212, 215, 216; often massive; columnar, fibrous, parallel, or divergent; or compact; very brittle; fracture sub-conchoidal or uneven; semitransparent to opaque; lustre vitreous, often splendant, sometimes only glimmering; sometimes white, red, blue, pink, or mottled, but more usually brown, green, or black; streak white; H. 7·7·5 (if Zeuxite is a variety the H. is as low as4); G. 2·9-3·3; pyro-electric; frictio-electric.

Var. 1. Schorl is the dark coloured and nearly opaque variety, containing a large proportion of iron, which is common in many of the granites of Devon and Cornwall.

2. Zeuxite is, perhaps, a variety. It occurred in translucent, four-sided greenish-brown prisms.

3. Rubellite is a red and semitransparent variety.

4. Indicolite is blue and semitransparent.

5. Peridot is yellow and semitransparent.

6. Achroite is colourless and transparent.

These last four are all foreign.

B., etc. In matrass no change; on C fuses at about 3 to a dark usually magnetic slag; with fluor and bisulphate of potash melts and colours the flame green; with borax and micro. the dark varieties usually give reactions for iron; insoluble in HCl or HNO_3; the powder slowly decomposed by H_2SO_4.

Comp. Anhydrous silico-borate of alumina and various bases. Of the accompanying analyses a. and b. were fine black specimens from Bovey Tracey, analysed by Mitscherlisch, and Gmelin;

c. is the analysis of Zeuxite, from Huel Unity, by Thomson, for comparison:—

	a.	b.	c.
Silica	37·00	35·20	33·48
Boric anhydride	7·66	4·11	—
Alumina	33·09	35·50	31·85
Peroxide of iron	9·33	17·86	—
Protoxide of iron	6·19		26·01
Oxide of manganese	—	1·43	—
Magnesia	2·58	0·70	—
Lime	0·50	0·55	2·46
Soda	1·39	2·09	—
Potash	0·65	—	—
Phosphoric anhyd.	0·12	—	—
Fluorine	1·49	—	—
Water and loss	—	—	5·28
Total	100·00	97·44	99·08

With silica = 39·3 per cent., alumina 45·0 per cent., and protoxide of iron 15·7 per cent. the formula might be written $\dddot{F}e2\ddot{A}l_3\dot{3}Si$ or $FeSiO_3 2Al_2SiO_5$ or $Al_2(SiO_3)_3 + (Al_2O_3 + B_2O_3) + FeO$. It would, however, thus become necessary to regard part of the alumina as being replaced by boric anhydride. A general formula for all the tourmalines is sometimes given as $(3\dot{R}, \ddot{R}_2\ddot{B}_2)\frac{2}{3}\ddot{S}i$. Dana gives a very large number of analyses of tourmalines, from many localities.

Loc. Cornwall—a. Black or very dark green Tourmaline (Schorl).—Fine specimens have occurred on Roscommon Cliffs (Figs. 215, 216), Botallack Mine, the Crowns, Boscaswell Downs, Boscawen Cliffs, Cape Cornwall, Pendeen Cove, with fine crystals of felspar, in schorl rock, and many other localities in St. Just; the Land's End, brownish and radiating; Wicca Cove, near Zennor; Rosemergy and Morvah United; near the Logan Rock; Ding Dong; St. Michael's Mount; Huel Darlington; Great Work, Breage, in fine dark brownish-green radiating masses; Constantine; Mabe; Trevalgan, St. Ives Consols, and other places in St. Ives; Providence Mines; Herland and Relistian, in Gwinear; Huel Druid, Dolcoath, Cook's Kitchen, Carn Brea, Ting Tang, West Huel Jewell, and many other localities in Gwennap; Carclaze, and other localities near St. Austell; Luxulyan, in porphyry, near the Viaduct; St. Cleer, in granite; Kit Hill United, &c.

Devon—Very fine black crystals, like Fig. 212, occurred many years ago in a quarry of red granite at Chudleigh; near Bovey Tracey, associated with fine crystals of white and translucent apatite. Good specimens, not distinctly crystallized, have occurred near Chagford; Birch Tor Mine, North Bovey; Bovey Heathfield; Haytor; near Okehampton; Blatchford, near Cornwood; Holme Lee; Buckfastleigh; Ugborough Beacon; Bowdley, near Ashburton; generally on the flanks of the granitic mass of Dartmoor; and Lundy Island.

b. Green Tourmaline occurs on the flanks of Carn Marth, and in white granite at Okehampton.

c. Achroite (?) occurs at Roscommon Cliffs, St. Just, in "small transparent colourless crystals," associated with black crystals, like Figs. 215, 216, and with a massive variety, with finely laminated and radiated structure.

d. Zeuxite occurred in the year 1814 at Huel Unity, in small translucent greenish-black crystals, much interlaced. (See Phil. Mag., August, 1855.)

The foreign localities of the various forms of tourmaline are exceedingly numerous.

Obs. Tourmaline may be easily distinguished from substances which somewhat resemble it by its specific gravity, longitudinal striations, brittleness, pyroelectricity, and by the form of the crystals when distinctly crystallized.

Angles.

R R	= 133° 08′	a t	= 142° 26′
R′ e′	156 34	a a′	120 00
R o	152 40	a b	150 00
R s	141 30	b b	120 00
R a	113 26	s o	134 02
a s	128 30	e e′	154 59

Towanite. See Chalcopyrite.

Translucent. See Diaphaneity.

Transmitted Light. See Reflected Light.

Transparent. See Diaphaneity.

Tremolite. See Amphibole.

Truncated. A term which is used in the same sense as *Modified*, which see.

Tungstate of Iron. See Wolfram.

Tungstate of Lime. See Scheelite.

Tungsten. See Scheelite and Wolfram.

Tungstic Acid.
Tungstic Anhydride.
Tungstic Ochre.
} See Wolframite

U.

Umber. See Limonite.

Uncleavable Fluor. See Fluor (Chlorophane).

Uncleavable Manganese Ore. See Psilomelane.

Uncleavable Uranium Ore. See Pitchblende.

Unctuous. Such minerals as feel slippery when handled are said to be "unctuous." *Ex.* Graphite, Lithomarge, Steatite.

Uneven. See Fracture.

Uranite. See Torbernite and Autunite.

Uranium. } See Pitchblende.
Uranium Ochre. }
Uranium Ore. }

Uran Mica. See Autunite and Torbernite.

V.

VALENTINITE.

[Oxide of Antimony, in part.] Rhombic; in prisms, with some faces curved or rough; longitudinal cleavages, very perfect; sectile; fracture not observable; semitransparent to translucent; lustre adamantine or pearly; white, to grey, yellow, brown, or red; streak white; H. 2·5-3·0; G. 5·5-5·6.

B., etc. In matrass sublimes completely; on C melts at 1, and deposits a crystalline white incrustation on the support; if mixed with soda and cyanide of potassium is readily reduced to a grey brittle bead, tinging the flame green; with borax forms a glass, which is yellow while hot, nearly colourless on cooling, like senarmontite; soluble in Aqua Regia, and re-precipitated on addition of water, if the solution be *concentrated*.

Comp. Anhydrous oxide of antimony ... like senarmontite. Sb_2 or Sb_2O_3, which is, therefore, dimorphous.

Loc. It is said to have occurred in white, fibrous, and radiated masses, with other antimony ores, at Lee, near Callington. It occurs also at several localities in Bohemia, Germany, France, &c.

Obs. It is to be distinguished from senarmontite by its crystalline form.

Variegated Copper Ore. See Erubescite.

Variegated Vitreous Copper is a mixture of Chalcocite and Chalcopyrite, found in some copper mines. It has the colours of tempered steel.

Vesicular. See Cellular.

Vitreous. See Lustre.

Vitreous Copper Ore. See Chalcocite.

Vitreous Silver Ore. See Argentite.

VIVIANITE.

[Phosphate of Iron. Blue Iron Earth.] Oblique; in prisms more or less modified (Figs. 168, 169, &c.); with perfect clino-diagonal cleavage (b) often acicular, aggregated, or divergent; also globular, reniform, fibrous, or earthy; sometimes investing other ores of iron; sectile, thin plates flexible; transparent to opaque; lustre pearly, vitreous, or sub-metallic; pale green to deep blue; crystalline or foliated specimens dichroic, often reddish or yellowish in some directions, and sometimes much like some micas; earthy varieties a very pure blue colour; streak bluish white, darkens on exposure, colour of powder liver-brown when dry; H. 1·5-2; G. 2·6-2·7.

Var. a. Crystallized Vivianite, often green, sometimes emerald-green and transparent.

b. Blue Iron Earth. Soft, earthy, and without lustre; colour a very beautiful pale blue. It is sometimes nearly white when first obtained.

B., etc. In matrass gives off much water; on C melts at 1 to a grey shining magnetic bead, colouring the flame bluish-green; with borax and micro. gives Fe reactions; soluble in HCl and HNO_3.

Comp. The following analysis of a specimen from St. Agnes is by Stromeyer:—

Phosphoric anhydride	31·18
Oxide of iron	41·23
Water	27·48
Total	99·89

Loc. Botallack and Huel Edward, St. Just, formerly, and again at Huel Edward, recently, in fine foliated masses of greenish, reddish, yellowish, and brownish colours, also in acicular crystals, and as Blue Iron Earth; Parknoweth, formerly, compact and earthy; Huel Gorland; Huel Jane and Huel Falmouth, in fine flat crystals on pyrites and pentlandite; Huel Kind, formerly, in the finest crystals ever found, some two inches long and three-quarters of an inch across, on pyrrhotite with chalybite; Huel Betsy and Huel Friendship, near Tavistock. Found also in alluvium near Bristol, and in mud in the Isle of Dogs, London, as well as in several other British and many foreign localities.

Obs. The Cornish crystals are not often distinctly terminated.

Angles.

O M =	117°	40′	v b =	120°	25′
O a	125	47	y y′	154	14
O v	149	35	y a	167	07
M M′	111	12	b r	109	34
M a	145	36	b z	105	19
M b	124	24	n a	144	20

W.

Wad. A Cumberland name for graphite.

WAD.

[Earthy Manganese. Bog Manganese.] Amorphous; often reniform, botryoidal, arborescent, pulverulent, or investing; occasionally so full of cavities as to appear *frothy*; sometimes with a curved lamellar structure; sectile or brittle; fracture earthy; opaque; lustre submetallic, glimmering, or dull; dark brown or nearly black; streak dark brown; *scratch* shining; soils the fingers; H. 0 to 3·0; G. 2·3-3·7.

B., etc. In matrass yields much water; on C infusible; with borax or micro. gives reactions for Mn; soluble in warm HCl, giving off Chlorine.

Comp. Impure hydrated manganic oxide, with often a proportion of oxide of cobalt, in which case it may be regarded as passing into asbolane. Sometimes a quantity of black oxide of copper is present. The following analysis of a specimen from Upton Pyne is by Turner:—

Manganic sesquioxide	79·12
Oxygen	8·82
Water	10·66
Boric oxide	1·40
Total	100·00

Loc. Huel Bucketts; Pednandrea; South Tolgus; Gerrans; Lifton, near Launceston, in botryoidal masses; Upton Pyne, in dark brown masses of very low specific gravity. It occurs also in Derbyshire and Scotland; and in Germany, France, and other foreign localities.

Warringtonite. See Brochantite.

WAVELLITE.

[Hydrargillite.] Rhombic; usually in hemi-spherical or globular masses, with radiated structure; brittle; fracture uneven or sub-conchoidal; translucent; lustre pearly, silky, or vitreous; yellowish, greyish, greenish, bluish; sometimes a brown or black tarnish; streak white; H. 3·5-4; G. 2·3-2·4.

B., etc. In matrass yields water and turns white; on C fuses with intumescence to a white opaque mass, tinging the flame bluish-green; with Co turns blue; soluble in HCl, HNO_3 and KHO; with micro. yields traces of fluorine.

Comp. Hydrated phosphate of alumina, as appears from the following analyses of specimens from Barnstaple. a. and b. by Fuchs, c. by Berzelius:—

	a.	b.	c.
Phosphoric anhyd...	35·12	34·84	33·40
Alumina	37·20	37·16	35·35
Fluorine	—	—	2·06
Peroxides of iron & manganese	—	—	1·25
Lime	—	—	0·50
Water	28·00	28·00	26·80
Total	100·32	100·00	99·36

With phosphoric anhydride = 35·1 per cent., alumina = 33·2 per cent., and water = 26·7 per cent. the formula may be written $3Al_2 2P_2 + 12H_2$ or $3Al_2O_3 2P_2 O_5 + 12H_2O$ or $P_4O(Al_2O_6)_3 12OH_2$.

The following analyses, d. from Barnstaple, by Klaproth; e., ditto, by Davy; f., Cornwall, by Gregor, are given in Jameson's Mineralogy, I., p. 334, 1816:—

	d.	e.	f.
(Phosphate) alumina	71·50	70·0	58·70
Oxide of iron	0·50	—	0·19
Lime	—	1·4	0·37
Silica	—	—	6·12
Water	28·00	26·2	30·75
Loss	—	2·4	3·87
Total	100·00	100.0	100·00

Loc. It is said to have been found at Beam Mine; at Stenna Gwynn, on decomposing granite, in greyish-green radiated masses, about as large as peas; and at Kit Hill, on elvan. The best known locality is Filleigh, near South Molton, near Barnstaple, on clay-slate.

Obs. "It was first discovered about the year 1785, by Mr. I. Hill, of Tavistock, and, being mistaken for a pure *hydrate* of alumina, it was called Hydrargillite, until Dr. Wavell, of Barnstaple, about thirty years afterwards, shewed that phosphoric acid was present in large quantities, and the substance, which thus constituted a new species, was named Wavellite. The usual form of this mineral is that of a hemisphere, varying in size from one-twentieth of an inch to one inch in diameter. When broken, the internal structure is found to be composed of acicular crystals, finely radiated. Wavellite is also found frequently filling small crevices in the slate rock, and not having had sufficient space to crystallize in its primary form, it has accommodated itself to the breadth of the fissure, spreading out and covering the surfaces of the rock with a profusion of radiated circles, which are sometimes two inches in diameter, and vary in thickness from one-eighth to a film not more than 1-200th of an inch" (Trans. Dev. Assoc., vol. II., pt. II., p. 341, 1868). Wavellite has also occurred in

Northumberland, Scotland, Ireland, and many foreign localities.

Wheel Ore. See Bournonite.

White Antimony Ore. See Senarmontite and Valentinite.

White Arsenic. See Arsenolite.

White Cobalt. See Cobaltite and Smaltite.

White Lead Ore. } See Cerussite.
White Lead Spar. }

White Mundic. See Leucopyrite, Marcasite, and Mispickel.

White Iron Pyrites, White Sulphuret of Iron. See Marcasite.

White Vitriol. See Goslarite.

Wild Lead. An old term for Blende.

WITTICHENITE.

Rhombic, in small, nearly square prisms; more usually in imperfect aggregations of acicular crystals with one perfect vertical cleavage; or massive, with coarse columnar cleavage; also disseminated; brittle; opaque; lustre metallic; tin-white to steel-grey; readily tarnished by exposure to light or air streak black; H. 3·5; G. 4·3-5.

B., etc. In matrass yields a light sublimate; in open tube gives a white sublimate and a strong sulphureous odour; on C fuses at 1, giving off brilliant sparks and coating the support dark brownish-yellow; with soda yields a globule of copper; soluble in HCl or HNO_3; the solution yields a white precipitate when largely diluted with water.

Comp. Anhydrous sulphide of bismuth and copper. A specimen from Baden yielded to Klaproth 47·24 per cent. of bismuth, 34·66 per cent. of copper, and 12·58 per cent. of sulphur.

Loc. The "Cupreous Bismuth," formerly reported from Botallack, Levant, and Huel Buller may, possibly, have been this species. That from Huel Buller occurred "in perfect hexagonal prisms, tin-white and lustrous when first raised, but soon becomes dull and tarnished." (Garby, Trans. R. G. S. C.)

WOLFRAM.

[Tungstate of Iron.] Rhombic; sometimes in crystals, like Figs. 118, 119, with perfect and easily obtained cleavage parallel to M; less perfect parallel to b u; crystals are usually imbedded, and often striated, curved, or macled; sometimes in acicular crystals; often massive; brittle, fracture uneven; opaque; lustre metallic or sub-metallic, brilliant on freshly exposed surfaces; dark greyish or brownish-black, not unfrequently with an iridescent tarnish; streak dark reddish-brown; H. 5-5·5; G. 7-7·6; some specimens feebly magnetic.

B., etc. In matrass decrepitates strongly and breaks up into thin flakes, but is otherwise unchanged; on C fuses at 4 to a black magnetic mass, sometimes crystalline on the surface; fused with soda forms a green mass; with borax and micro. gives Fe and Mn reactions; slowly decomposed by warm HCl, more readily with Aqua Regia, with deposition of yellow tungstic anhydride.

Comp. Anhydrous tungstate of iron, with some manganese, as appears from the following analysis of a specimen from Godolphin Bal by Kerndt, the specific gravity of which was 7·21:—

Tungstic anhydride	75·92
Oxide of iron	19·35
Oxide of manganese.....	4·73
Total.....	100 00

With tungstic anhydride = 77·10 per cent., oxide of iron = 18·27 per cent., and oxide of manganese = 4·63 per cent.

the formula might be written 4Fe, Mn5W or (4-5 Fe 1-5 Mn)WO_4.

Loc. St. Michael's Mount, with cassiterite, fluor, topaz, &c.; Godolphin Bal, Breage; Huel Prospidnick, Sithney; Herland; Dolcoath; Cook's Kitchen; Tincroft; Carn Brea; East Pool, in acicular crystals, and in large macles, with striated or curved surfaces, imbedded in quartz or chlorophane; Pednandrea, imbedded in chlorite, both massive and crystalline; Huel Fanny, in prisms (Figs. 245, 246); Huel Harmony; Poldice, massive and acicular, in quartz and chlorite; Cligga; Stenna Gwynn, crystallized; Beam Mine; Goonbarrow; Gunnislake; Drake Walls, fibro-lamellar and massive; Kit Hill; &c. Wolfram has also been found at Huel Friendship and several other mines near Tavistock.

Obs. The Cornish specimens, although often very fine and pure, are seldom distinctly crystallized, they are frequently imbedded in quartz, in large cleavable masses or imperfect tabular crystals. Wolfram may be distinguished from Cassiterite by its perfect cleavage, inferior hardness, and dark streak; from Blende and Schorl by the colour of its streak, and by its sp. gr.

Angles.

M M =	101° 05′	b a =	90° 00′
M t	110 46	b t	117 20
M b	140 32	u u	99 12

The plane M is striated *vertically*.

WOLFRAMITE.

[Wolframine. Wolfram Ochre.] Cubic? in earthy or pulverulent masses, investing wolfram; opaque; dull; yellow, greenish, or brownish; H. 0-1.

B., etc. In matrass gives off water and turns black; on C infusible; with borax forms a *colourless* bead, unlike the other minerals with which it may be confounded (Yellow Ochre, Zippæite, &c.); insoluble in HCl; soluble in caustic alkalies.

Comp. Hydrated (?) oxide of Tungsten, or, more probably, tungstic anhydride which has absorbed some moisture from the air.

Loc. East Pool, Poldice, Drakewalls, and Huel Friendship, investing wolfram. Found also in Cumberland, France, and the United States.

Wood Arseniate of Copper. See Olivenite.

Wood Iron Ore. See Limonite.

Wood Tin. See Cassiterite.

Woodwardite, An impure Langite, or mixture of Langite and Allophane. It occurs in minute concretions of a turquoise-blue or greenish-blue colour, and is translucent or almost transparent; sp. gr. 2·38. It is soluble, almost completely, in dilute HCl or HNO_3. Of the following analyses the first, a., is by Professor Church; b., c. are by Warrington; d. is a very similar mineral, analysed by Pisani. In a., b., c. there were traces of silica, lime, magnesia, and phosphoric anhydride:—

	a.	b.	c.	d.
Sulphuric anhy.	13·95	13·04	12·54	11·7
Oxide of copper	48·34	48·67	46 80	46·8
Alumina	17·97	18·64	17·93	13·4
Silica	—	—	—	1·2
Water	18·48	19·65	22·73	26·9
Total	98·74	100·00	100·00	100·0

Another mineral, much resembling Woodwardite, yielded to Pisani:—

Sulphuric anhydride	4·7
Oxide of copper	17·4
Alumina	33·8
Silica	6·7
Water	38·7
Total	101·3

M. F. Pisani therefore regards both Woodwardite and this new mineral as mixtures, in very different proportions, of Langite and Allophane.

A specimen of a similar Cornish mineral, examined recently by Professor Maskelyne and Dr. Flight, had the composition given below. "It occurs in very thin crusts, of various shades of yellow and green, the surface exhibiting a wavy appearance. Though the outer surface is occasionally somewhat compact, the mass is loose, and some of the layers pulverulent. a. shews the composition of the inner layer, and b. that of the outer crust":—

		a.		b.
Ox. of copper.		24·561		10·255
Alumina		23·063		27·250
Lime		0·086		1·403
Magnesia		0·749		6·183
Soda		—		0·640
Sulph. anhyd.		6·775		2·433
Silica		6·689		7·538
Carb. anhyd.		—		0·528
Water: Lost at ord. temp.	15·390	13·938		
100°	10·413			
120°-260°	7·333	23·864		
over 260°	5·392	6·167		
		38·528		43·969
Total		100·451		100·199

For further information see Church, Chem. News, XIII., 85, 113, 1866, and Journ. Chem. Soc., II., iv., 130; Pisani, Phil. Mag., April, 1868, p. 320; Maskelyne and Flight, Journ. Chem. Soc., Jan., 1871, p. 1. See also Langite.

Y.

Yellow Copper Ore. See Chalcopyrite.

Yellow Ochre. See Limonite.

Yellow Oxide of Tungsten. See Wolframite.

Yellow Oxide of Uranium. See Zippæite.

Z.

Zeuxite. See Tourmaline.

Zinc Blende. } See Blende.
Zinc Glance. }

Zinc Spar. See Calamine.

Zinc Vitriol. See Goslarite.

ZIPPÆITE.

[Uranochre, &c.] Amorphous: earthy or pulverulent; opaque; dull; lemon, or sulphur-yellow, or sometimes brownish-red; H. 0-1.

B., etc. In matrass yields water and darkens in colour; on C turns green but does not fuse; with borax and micro. yields uranium reactions; soluble in HNO_3, forming a yellow solution.

Comp. Oxide of uranium, probably hydrated.

Loc. Huel Edward, St. Just; St.

Michael's Mount, coating mica on quartzose rock. "A specimen given to Mr. Greg by Mr. Nuttall appears to be slightly crystallized in plates, as if the result of the decomposition of uranite'" (Greg and Lettsom, p. 382). Formerly in small green earthy globules, on pitchblende, at Huel Buller; Carharrack; more recently at Pednandrea and Clyjah Mine; and at Goonbarrow (?); Withiel Iron Mine, Restormel. Formerly in considerable abundance at a tin mine in Callington. Zippæite has also been found in several foreign localities.

THE END.

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ADDENDA.

ANTHRACITE.—The Author has found thin layers in the joints of the rocks at Pednandrea Mine, and at Roscrow United Mines, Ponsanooth.

AXINITE.—Additional localities to those on p. 12, Pt. II:—Old Treburgett, St. Teath; and Ivy Tor, Copper Hill Mine, Huel Forest, Fursdon Manor Mine, Meldon Quarry—all in Devon. See Trans. Dev. Assoc., vol. II., Pt. II., p. 344, 1868.

ELÆOLITE.—(Nepheline) Hexagonal; Brittle; fracture conchoidal or uneven; transparent to semi-translucent; lustre vitreous to resinous; colourless, grey, red, brown, or bluish green; streak white, H. 5·5—6·0, G. 2·58—2·64.

B., etc. Infusible or fusible with difficulty; with Co. turns blue; translucent splinters become opaque if treated with HNO_3, Powder decomposed by HCl.

Comp. Anhydrous Silicate of Soda, Potash, and Lime.

Loc. The Wolf Rock, nine miles S.E. of the Land's End—with glassy Felspar and green Hornblende in yellowish grey masses of imperfect Crystals. "The greater part of the mass of the rock is seen to consist of 'Nepheline,' the Crystals varying in size from the 1″/150 to 1″/310 across." S. Allport, F.G.S., in Geol. Mag., June, 1871.

EPIDOTE.—A specimen from Old Treburgett Mine, St. Teath, associated with Axinite, is in the Museum of the Royal Institution of Cornwall.

PITTICITE.—The following is an analysis of a specimen from Redruth (Dolcoath?) by Professor A. H. Church, M.A.:—

"Carefully selected homogeneous portions of a fine specimen of this mineral from Cornwall were submitted to analysis, after having remained a year or more in my cabinet. They evidently still contained a considerable amount of hygroscopic water.

Water lost at 100° C.	8·76
,, lost at 175°	7·53
,, retained at 175°	8·63
Ferric oxide	32·54
Arsenic pentoxide	33·99
Phosphorus pentoxide	1·27
Sulphur trioxide	7·28
	100·00

Regarding the water lost at 100° as non-essential or accidental, we may recalculate the above numbers as follows:—

Water	17·71
Ferric oxide	35·67
Arsenic pentoxide	37·25
Phosphorus pentoxide	1·39
Sulphur trioxide	7·98
	100·00

I fear that these numbers throw no fresh light upon the constitution of this very variable mineral, and that no satisfactory formula can be deduced from them. One peculiarity of the Cornish specimens consists in the high proportion of arsenic pentoxide which they contain, a proportion which is greater than that in this mineral as derived from any other recorded locality. But, on the other hand, the Cornish Pitticite shows a smaller quantity of ferric oxide than other analysed specimens. It does not appear that phosphorus pentoxide has been previously detected in this mineral. I ought to add that the Cornish mineral was straw to ochre-yellow in colour, subreniform and massive in form, and in great part opaque. The softest, palest, and most homogeneous portions were selected in preparing the sample for analysis. It is not improbable that the darker and less opaque portions would have shown a higher percentage of iron.

ORTHOCLASE.—The following analysis, by Professor Church (who has favoured the author by communicating it), is of

an Orthoclase from a quarry near Roche, where it occurs as a rock, in large sub-opaque white masses, with thin veins of white Quartz and white Mica. Its specific gravity is 2·56.

Silica	63·70
Alumina	19·76
Ferric oxide	·71
Lime	trace.
Potash	13·61
Soda	2·26
	100·04

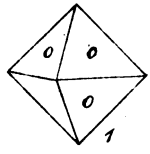
SILVER.—The following is an analysis of a specimen from Huel Ludcott, by Professor Church. Sp. gr. 10·26.

Silver	97·86
Chloride of Silver	·71
Gold and Antimony	·21
Iron	·15
Metals precipitable by H_2S	·10
Loss	·97
	100·00

PSEUDOMORPHS.—A fine specimen of Calcedony in cubes—probably Pseudomorphous after Fluor—is in the Museum of the Royal Institution of Cornwall. It is believed to be from Beeralston.

HEMATITE occurs in irregular nodules in brownish red clay near Totnes, Devon.

Plate 1.



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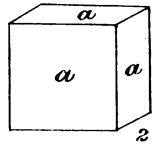

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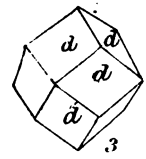

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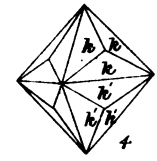

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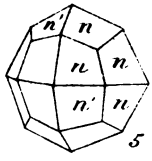

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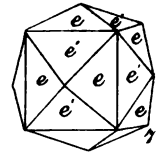

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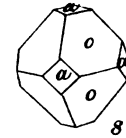

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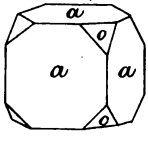

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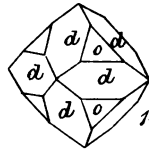

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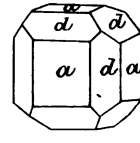

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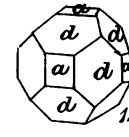

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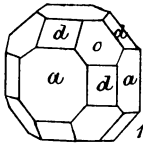

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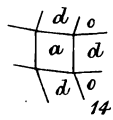

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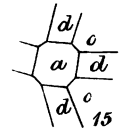

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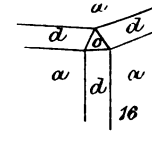

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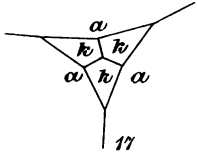

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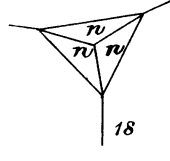

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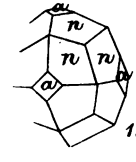

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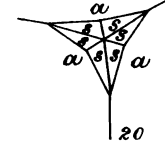

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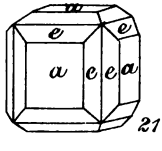

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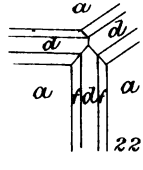

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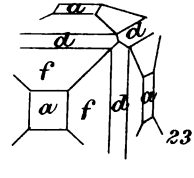

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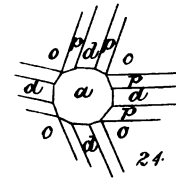

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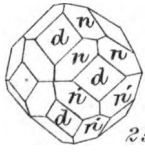

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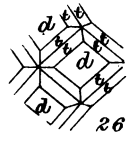

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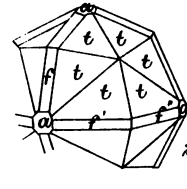

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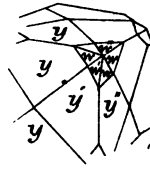

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PLATE I.

CUBICAL SYSTEM.

Fig.

1. OCTAHEDRON. Cuprite, Fluor.
2. CUBE. Pyrites, Cuprite, Fluor.
3. RHOMBIC-DODECAHEDRON. Garnet, Cuprite.
4. TRIAKIS-OCTAHEDRON. Pyrites, Galena.
5. DELTAHEDRON. Garnet, Argentite, Analcite.
6. HEXAKIS-OCTAHEDRON. Fluor.
7. TETRAKIS-HEXAHEDRON (FOUR-FACED CUBE.) Fluor, Cuprite.
8. Kerate, Argentite, Cobaltite, Fluor, Galena.
9. Kerate, Argentite, Fluor, Galena.
10. Fluor, Blende, Galena, Silver.
11. Galena, Cuprite, Silver.
12. Galena, Cuprite.
13. Galena, Cuprite.
14. Galena, Cuprite.
15. Argentite, Cuprite.
16. Fluor, Cuprite, Pyrites.
17. Fluor.
18. Fluor, Smaltite.
19. Argentite, Analcite.
20. Argentite.
21. Fluor.
22. Fluor.
23. Fluor.
24. Fluor, Cuprite.
25. Garnet.
26. Garnet.
27. Fluor.
28. Fluor.

PLATE II.

CUBICAL SYSTEM *(Cont.)*

Fig.

29. Galena, Fluor.

30. Fluor.

31. Fluor, Garnet.

32. Pyrites, Fluor.

33. TETRAHEDRON. Fahlerz.

34. DELTOID-DODECAHEDRON. Fahlerz.

35. TRIGONAL-DODECAHEDRON. Blende, Fahlerz.

36. Diamond.

37. Blende, Tennantite.

38. Fahlerz.

39. Blende, Fahlerz.

40. Fahlerz.

41. Fahlerz.

42. Blende, Fahlerz, Tennantite.

43. PENTAGONAL-DODECAHEDRON. Pyrites, Cobaltite.

44. Pyrites, Cobaltite.

45. Pyrites, Cobaltite (very rarely.)

46. Pyrites, Cobaltite.

47. Pyrites.

48. Pyrites, Cobaltite.

49. Pharmacosiderite.

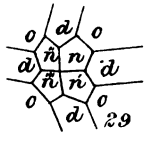
50. Pyrites, Pharmacosiderite.

51. Pharmacosiderite.

52. Pyrites, Blende.

53. Fluor.

Plate 11.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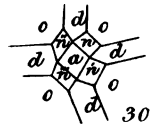
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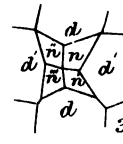
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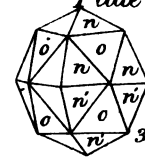
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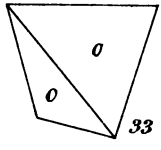
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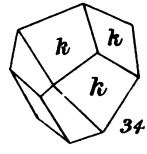
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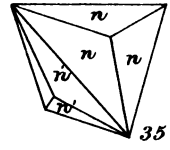
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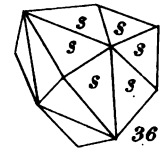
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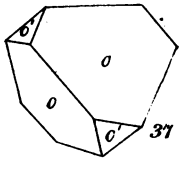
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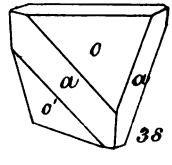
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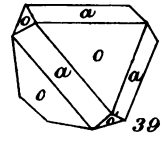
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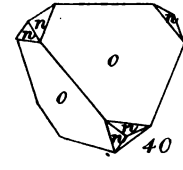
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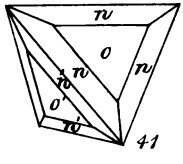
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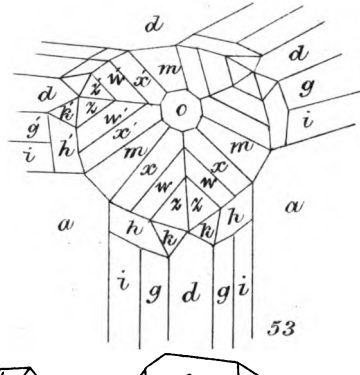
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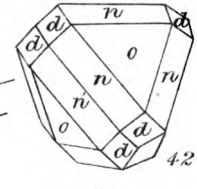
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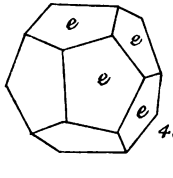
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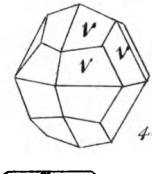
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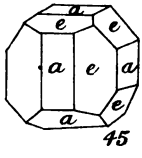
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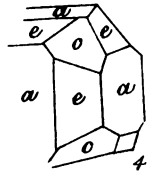
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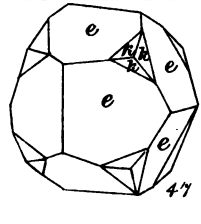
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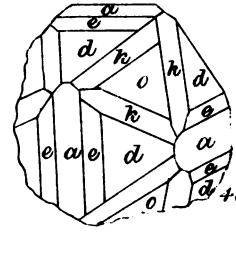
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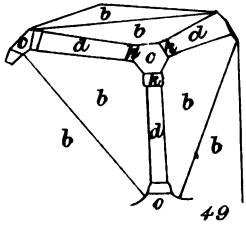
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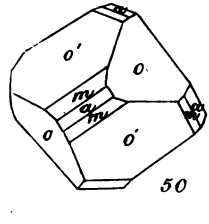
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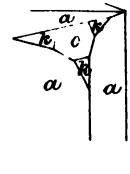
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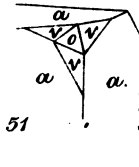
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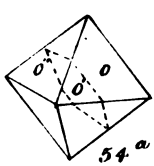
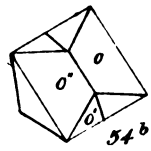
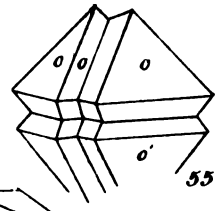
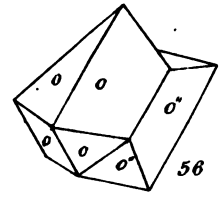
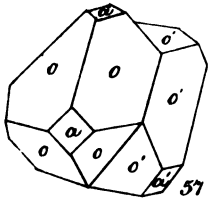
Plate III.

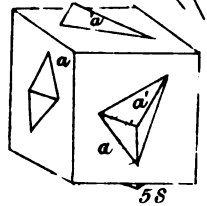


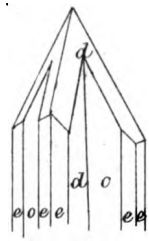


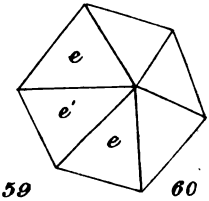


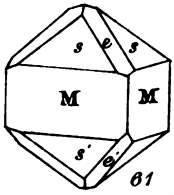


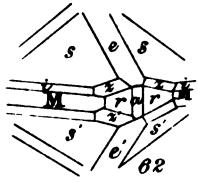


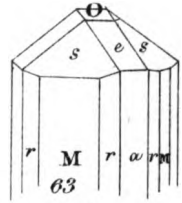


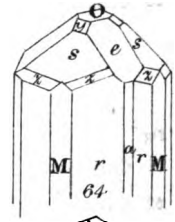


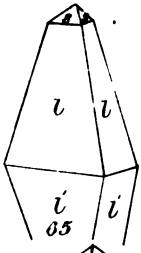


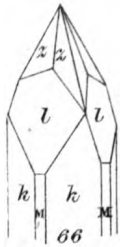


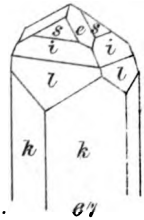


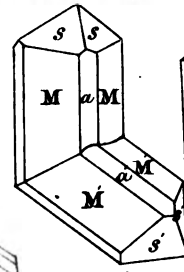


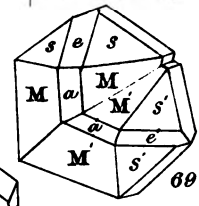


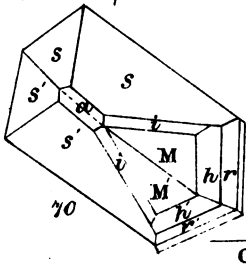


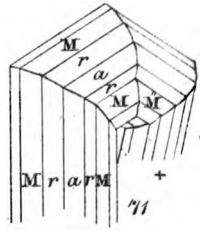


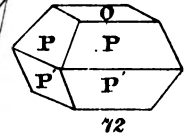


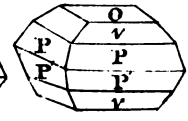


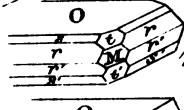


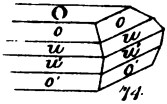


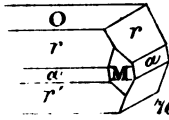


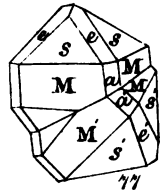












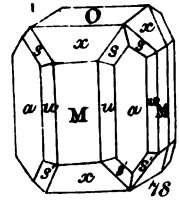


PLATE III.

CUBICAL SYSTEM *(Cont.)*

Fig.

54a. } Illustrations of Macles. (See page 65)
54b. }

55. Fluor. (Macled Octahedrons.)

56. Macled Octahedrons, Magnetite.

57. Macled Cube-Octahedrons.

58. Pyrites, Erubescite (Macle.)

59. Copper.

60. Copper.

PYRAMIDAL SYSTEM.

Fig.

61. Cassiterite.

62. Cassiterite.

63. Cassiterite.

64. Cassiterite.

65. Cassiterite.

66. Cassiterite.

67. Cassiterite.

68. Cassiterite (Macled.)

69. Cassiterite (Macled.)

70. Cassiterite (Macled.)

71. Cassiterite (Macled.)

72. Anatase.

73. Anatase.

74. Torbernite.

75. Torbernite.

76. Torbernite.

77. Cassiterite (Macled.)

78. Cromfordite.

PLATE IV.

PYRAMIDAL SYSTEM *(Cont.)*

Fig.

79. Chalcopyrite.

80. Chalcopyrite.

81. Chalcopyrite.

82. Chalcopyrite.

83. Chalcopyrite.

84. Torbernite, Chalcopyrite (Macled.)

85. Chalcopyrite (Macled.)

86. Scheelite.

87. Scheelite.

88. Scheelite.

RHOMBIC SYSTEM.

Fig.

89. Fluellite.

90. Mispickel.

91. Mispickel.

92. Mispickel.

93. Mispickel.

94. Andalusite.

95. Andalusite.

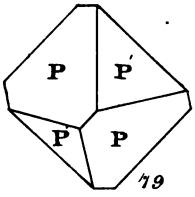
96. Prehnite.

97. Antimonite.

98. Bismuthinite.

99. Bismuthinite.

Plate IV.



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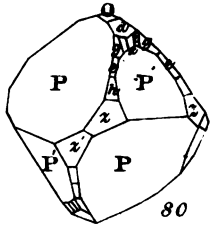

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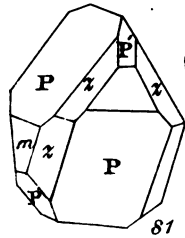

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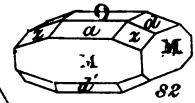

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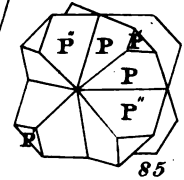

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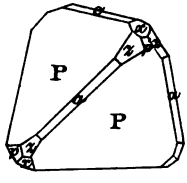

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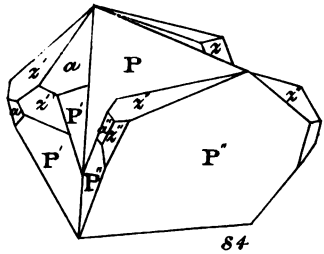

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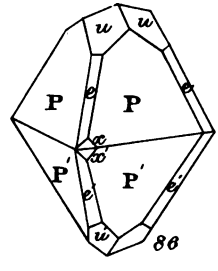

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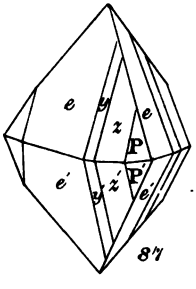

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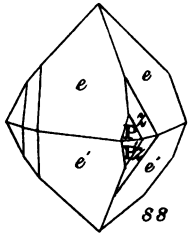

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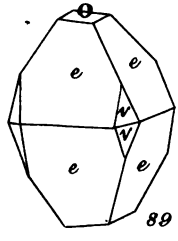

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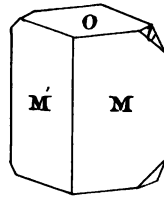

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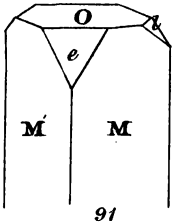

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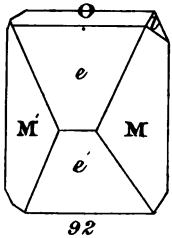

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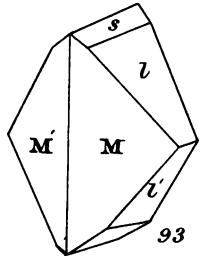

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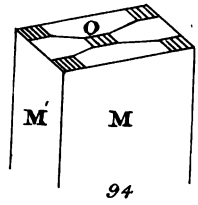

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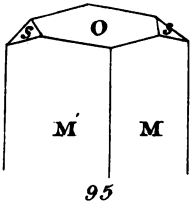

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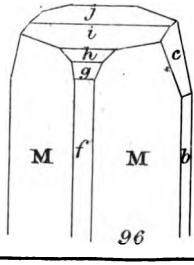

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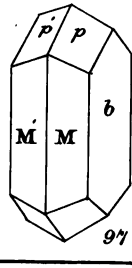

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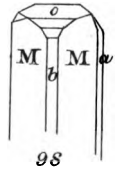

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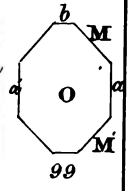

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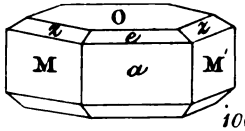
Plate V.



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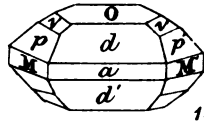

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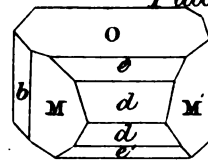

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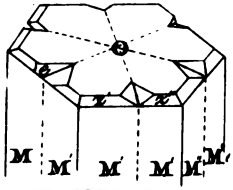
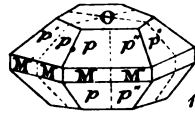
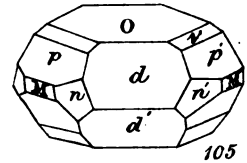
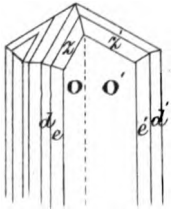
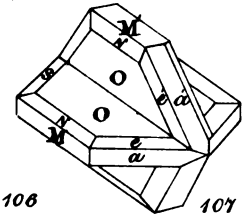
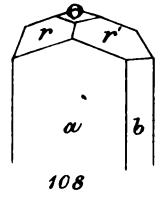


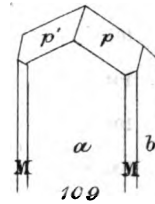


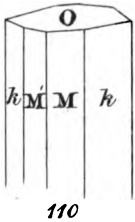


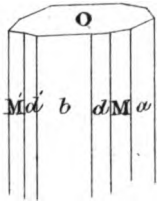


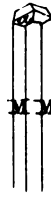


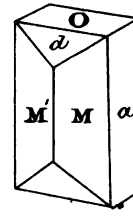


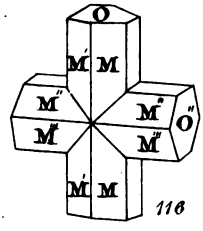


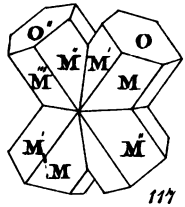


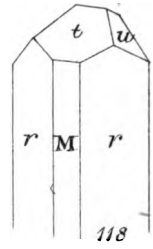


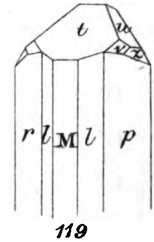


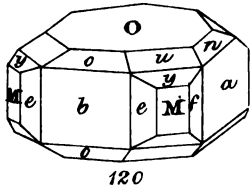


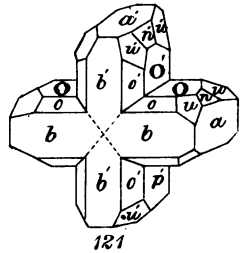


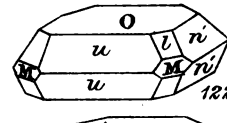












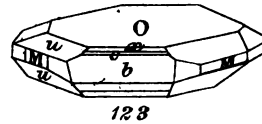


PLATE V.

RHOMBIC SYSTEM *(Cont.)*

Fig.

100. Chalcocite.

101. Chalcocite.

102. Chalcocite.

103. Chalcocite (Macled.)

104. Chalcocite (Macled.)

105. Chalcocite.

106. Chalcocite (Macled.)

107. Chalcocite (Macled.)

108. Stilbite.

109. Stilbite.

110. Manganite.

111. Pinite.

112. Natrolite.

113. Natrolite.

114. Wavellite.

115. Leucopyrite, Staurolite.

116. Staurolite (Macled.)

117. Staurolite (Macled.)

118. Wolfram.

119. Wolfram.

120. Bournonite.

121. Bournonite (Macled.)

122. Bournonite, Antimonite.

123. Bournonite.

PLATE VI.

RHOMBIC SYSTEM *(Cont.)*

Fig.

124. Goethite.

125. Goethite.

126. Goethite.

127. Anglesite.

128. Anglesite.

129. Anglesite.

130. Anglesite, Barytes, Celestite.

131. Anglesite, Barytes, Celestite.

132. Anglesite, Barytes, Celestite.

133. Anglesite, Barytes.

134. Anglesite, Barytes.

135. Anglesite, Barytes.

136. Olivenite, Barytes, Pyrolusite.

137. Olivenite, Barytes, Pyrolusite.

138. Olivenite.

139. Libethenite.

140. Cerussite.

141. Cerussite.

142. Cerussite (Macled.)

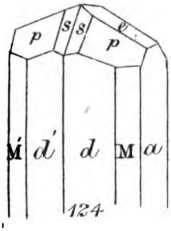
143. Childrenite.

144. Childrenite.

145. Childrenite.

146. Childrenite.

147. Brookite.



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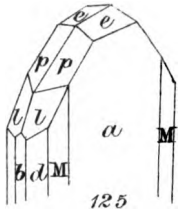

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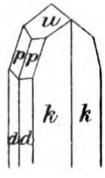

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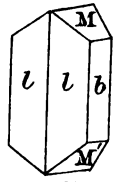

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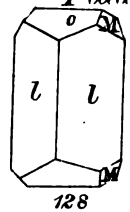

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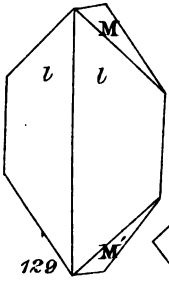

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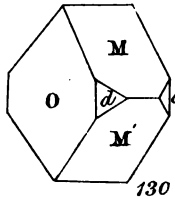

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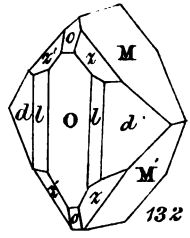

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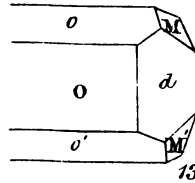

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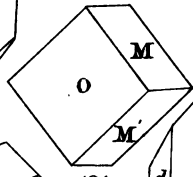

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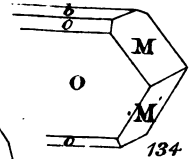

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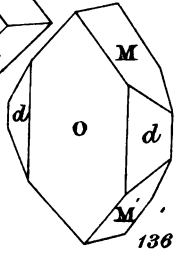

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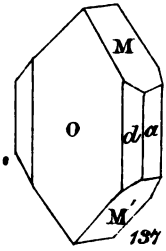

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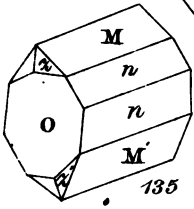

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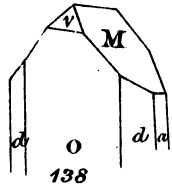

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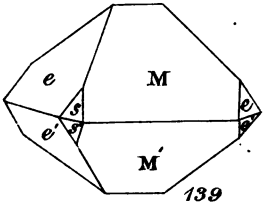

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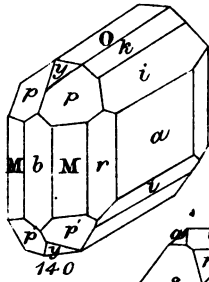

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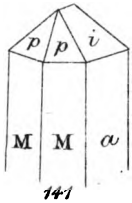

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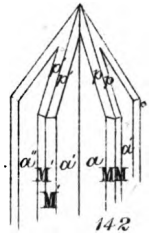

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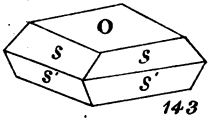

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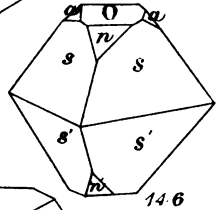

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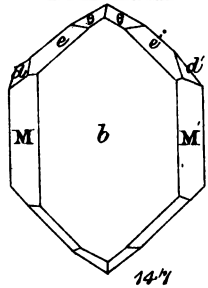

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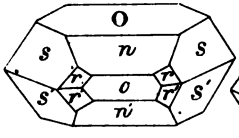

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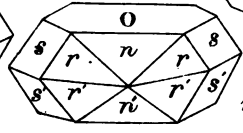
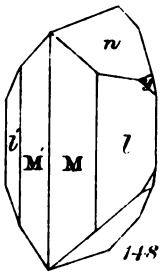


145.

Plate VII.



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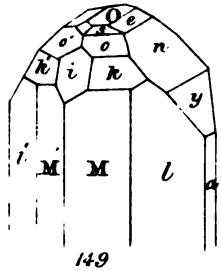

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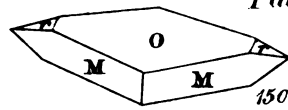

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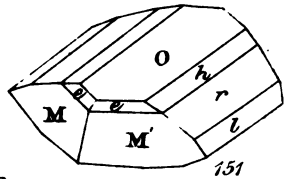

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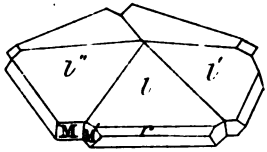

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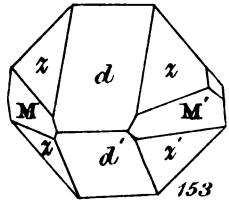

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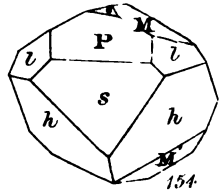

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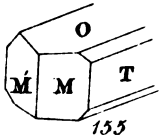

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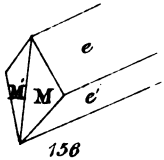

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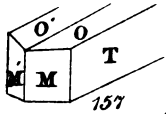

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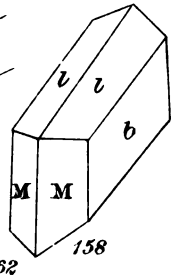

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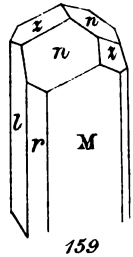

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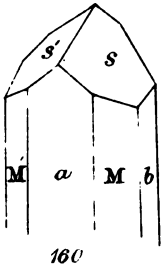

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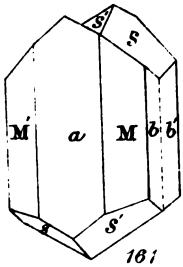

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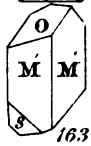

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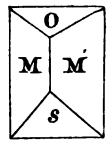

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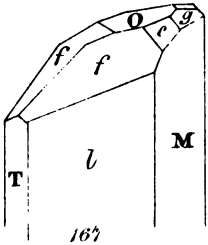

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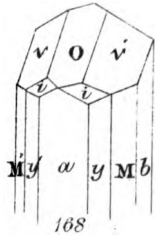

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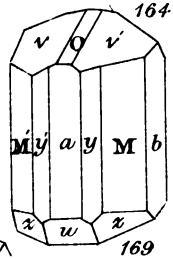

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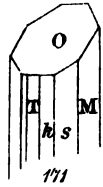

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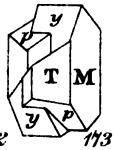

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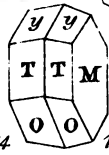

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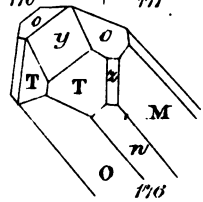

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PLATE VII.

RHOMBIC SYSTEM *(Cont.)*

Fig.
148. Topaz.
149. Topaz.
150. Marcasite.
151. Marcasite.
152. Marcasite (Macled.)
153. Chondrodite.

OBLIQUE SYSTEM.

Fig.
154. Chessylite.
155. Malachite.
156. Malachite.
157. Malachite.
158. Gypsum.
159. Epidote.
160. Pyroxene.
161. Pyroxene (Macled.)
162. Clinoclase?
163. Clinoclase.
164. Clinoclase.
165. Clinoclase, Liroconite.
166. Clinoclase.
167. Lunnite.
168. Valentinite, Vivianite.
169. Valentinite, Vivianite.
170. Erythrite.
171. Erythrite.
172. Orthoclase.
173. Orthoclase.

ANORTHIC SYSTEM.

Fig.
174. Albite.
175. Albite.

OBLIQUE SYSTEM.

Fig.
176. Orthoclase.

PLATE VIII.

OBLIQUE SYSTEM *(Cont.)*

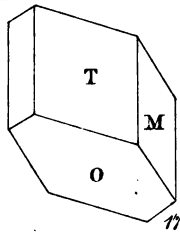
Fig.
177. Orthoclase.
178. Orthoclase.
179. Orthoclase.
180. Orthoclase.
181. Amphibole.

ANORTHIC SYSTEM.

Fig.
182. Albite.
183. Cyanosite.
184. Axinite.
185. Axinite.
186. Axinite.
187. Axinite.

HEXAGONAL SYSTEM.

Fig.
188. Beryl, Calcite, Mimetite, Pyromorphite.
189. Apatite.
190. Apatite, Mimetite, Pyromorphite.
191. Apatite.
192. Pyromorphite.
193. Beryl.
194. Beryl.
195. Calcite, Chalybite.
196. Apatite.
197. Quartz, Calcite, Dolomite.
198. Calcite.
199. Chalybite.
200. Calcite, Ilmenite.
201. Calcite, Chalcophyllite.
202. Chalybite.



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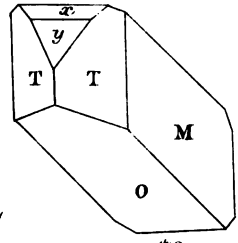

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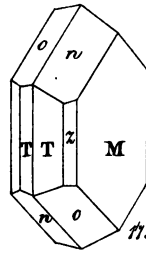

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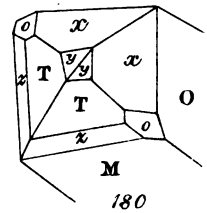

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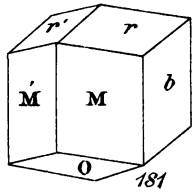

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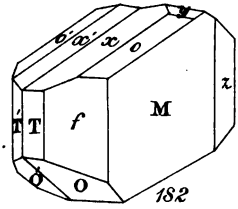

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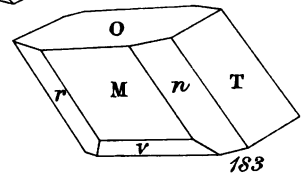

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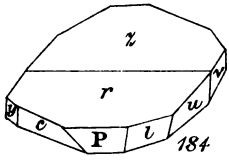

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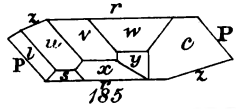

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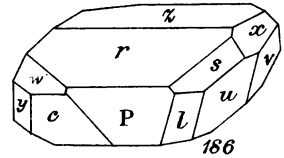

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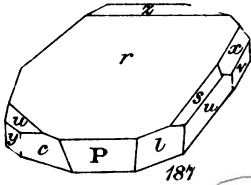

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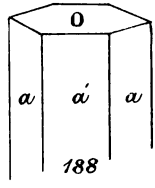

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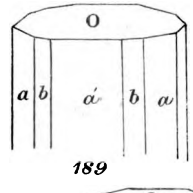

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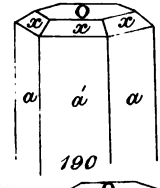

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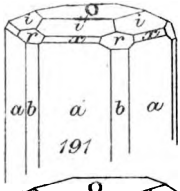

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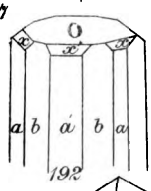

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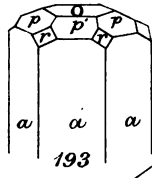

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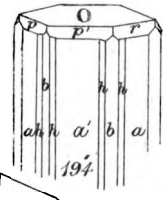

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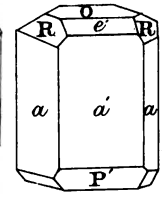

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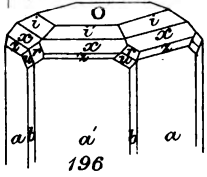

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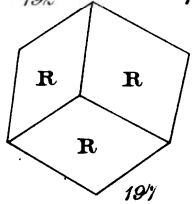

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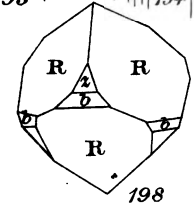

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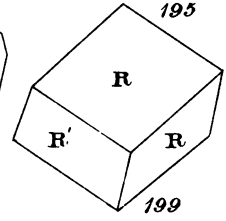

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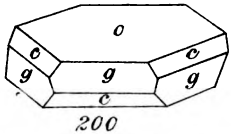

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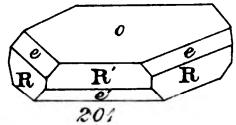

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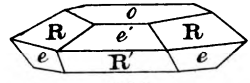

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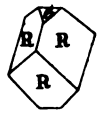
Plate IX



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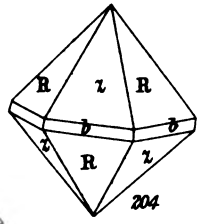

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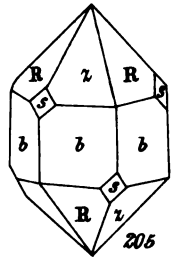

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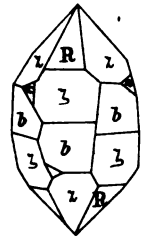

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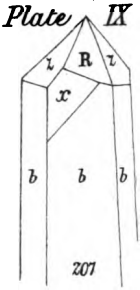

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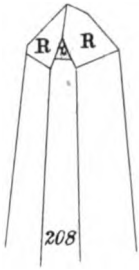

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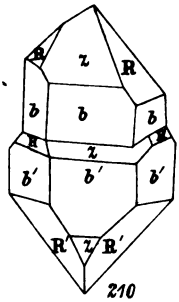

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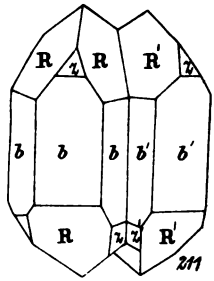

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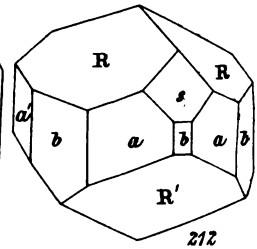

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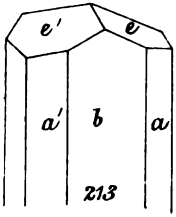

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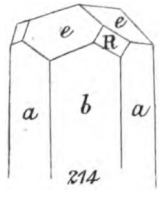

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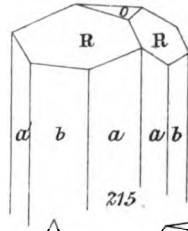

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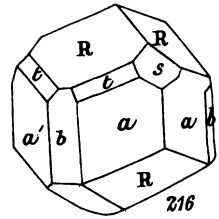

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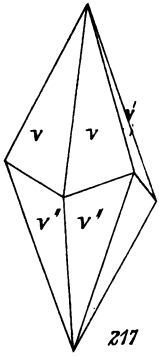

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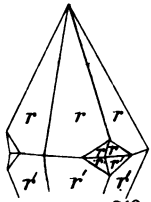

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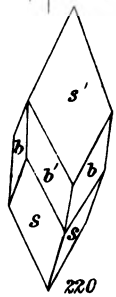

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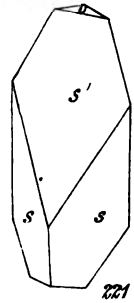

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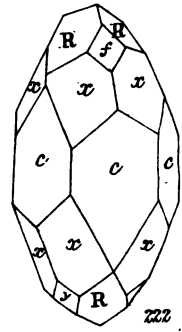

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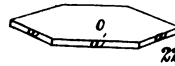

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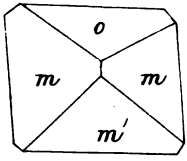

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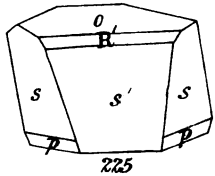

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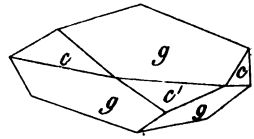

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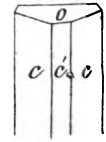

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PLATE IX.

HEXAGONAL SYSTEM *(Cont.)*

Fig.

203. Bismuth.

204. Quartz.

205. Quartz.

206. Quartz.

207. Quartz.

208. Quartz.

209. Quartz.

210. Quartz.

211. Quartz.

212. Tourmaline.

213. Pyrargyrite.

214. Pyrargyrite.

215. Tourmaline.

216. Tourmaline.

217. Calcite, Chalybite.

218. Calcite.

219. Cronstedtite.

220. Chalybite.

221. Antimony, Arsenic.

222. Calcite.

223. Calcite.

224. Chalybite.

225. Chalybite.

226. Calcite, Hematite.

227. Calcite.

PLATE X.

HEXAGONAL SYSTEM *(Cont.)*

Fig.

228. Connellite.

229. Connellite.

230. Hematite, Ilmenite.

231. Chalybite, Dolomite, Calcite.

232. Hematite.

233. Hematite.

---

234. Anatase *(Pyramidal.)*

235. Babingtonite *(Oblique.)*

236. Cronstedtite *(Hexagonal.)*

237. Cronstedtite *(Hexagonal.)*

238. Cronstedtite *(Hexagonal.)*

239. Muscovite *(Oblique?)*

240. Muscovite *(Oblique?)*

241. Muscovite *(Oblique?)*

242. Pyrolusite *(Rhombic.)*

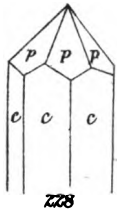
243. Quartz *(Hexagonal.)*

244. Scorodite *(Rhombic.)*

245. Wolfram *(Rhombic.)*

246. Wolfram *(Rhombic.)*

Plate X



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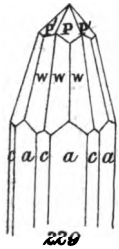

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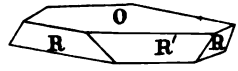

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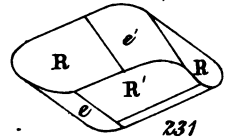

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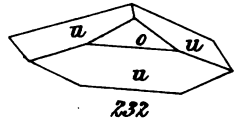

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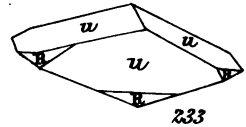

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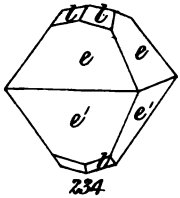

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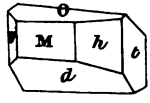

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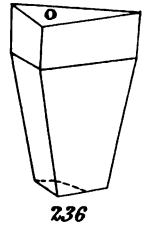

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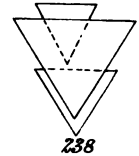
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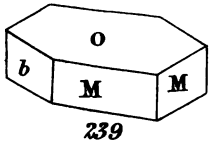

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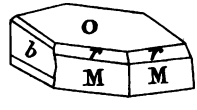

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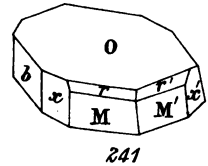

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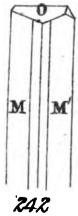

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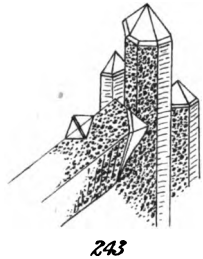
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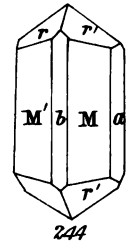

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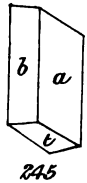

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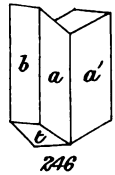

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